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Cover Photograph: Tolbert Farm Archaeological Complex. Calhoun County, Alabama, and associated surface collected biface points (inset). Photographs provided by Harry Holstein, Jacksonville State University, Alabama.

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CONTENTS

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PREVALENCE OF OVA OF THE NEMATODE PARASITE, TO*XOCARA SPP.*, IN THREE PUBLIC PARKS IN BIRMINGHAM, ALABAMA

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ABSTRACT

Twenty-four soil samples, (3 samples per park), were collected from eight public parks in Birmingham, Alabama. Soil samples were randomly collected from around monkey bars, slides and swings where human contact with *Toxocara* ova is likely to occur. Three hundred grams each were collected from the surface to a depth of 10cm. (Duwel, D.,1984, Mahdi and Ali, 1992). Soil samples of 50 grams were washed with tap water through a set of three sieves of mesh width of 250um, 120um and 30um respectively. Soil samples collected from the third sieve were transferred to 15ml centrifuge tubes and were tested for *Toxocara* using standard saturated magnesium sulfate flotation techniques (Quinn et.al., 1980). Ova belonging to *Toxocara* spp., were recovered from three parks (38%) and were found around swings (29) and slides (21). Ova recovered were intact and some were embroynated. Other nematode ova observed belonged to *Trichuris* spp. This study confirms earlier studies that soil contamination with ova of *Toxocara* spp., is widespread. Further study is needed to establish the seroprevalence of *Toxocara canis* in children and adults living around and utilizing contaminated parks.

INTRODUCTION

Toxocara canis is a cosmopolitan nematode parasite of dogs and other canids. Infection is very common in domestic dogs with a prevalence of greater than 80% in puppies 2 to 6 months of age, declining to less than 20% in dogs aged one year or older (Schmidt and Roberts, 1977). The life cycle of *Toxocara canis* is typical of the *Ascaridata* (Brown and Neva, 1983). Transmission is by ingestion of embryonated eggs containing the second stage larvae (L2). The fate of ingested L2 depends on the age of the dog. If ingested by young puppies, L2 will hatch in the small intestine, burrow in the blood vessels of the small intestine, make their way to the lungs by way of the heart, and be coughed up and swallowed. They attain sexual maturity in the small intestine and start to produce eggs in 4 to 6 weeks. In adult dogs, L2 do not always complete the cycle described above but encyst in various tissues of their host for a long period of time. If a female dog becomes pregnant, the dormant larvae become activated by host hormones and reenter the circulatory system, where they are carried

to the placenta and hence infect puppies transplacentally. Infection in humans is by accidental ingestion of *Toxocara canis* ova containing L2. Ingested L2 penetrate the intestinal mucosae and are carried by the blood stream to the liver, lungs, heart, brain, eyes and other organs causing two distinct disease entities known as visceral larval migrans (VLM) and ocular larval migrans (OLM) (Nelson et.al, 1996). VLM is characterized by persistent eosinophilia, bronchial asthma, leucocytosis, urticaria fever, hepatomegaly, pyogenic liver abscess, and hypergammaglobulinemia. (Rayes and Lambertucci, 1999; Humbert et.al, 2000; Hakim et. al, 1997; Guerra et. al, 1995, Gillespie, S.H., 2001). OLM is characterized by endophthalmitis, uveitis, pars planitis and granuloma formation (Gillespie et.al., 1993). Particularly at risk for the disease are small children who, because of their lifestyle and their playing environments can easily come into contact with *Toxocara canis* ova. This study was conducted to ascertain the prevalence of ova of *Toxocara* spp., in soils of eight public parks in the city of Birmingham, Alabama, using saturated magnesium sulfate flotation techniques.

MATERIALS AND METHODS

Twenty-four soil samples, (3 samples/park), were collected from eight public parks located in four residential zones in the city of Birmingham, Alabama (Table 1). Soil samples were randomly collected from around swings, slides and monkey bars. (Table 2). Clean polythene bags were used to collect soil samples (approximately 300g each) from the surface down to a depth of 10cm (Duwel, D. 1984). Soil samples were transported to the laboratory where they were air-dried for 7 days at room temperature. Soil samples of 50g were washed with tap water through a set of three sieves of mesh width of 250 um, 120um, and 30um, respectively (Duwel, D. 1984).

Soil samples collected from the third sieve were transferred to 15 ml centrifuge tubes and were mixed with 10ml of deionized water and were centrifuged at 2000rpm for 10 minutes. The supernatant was discarded and the precipitate was resuspended in 10 ml of saturated magnesium sulfate solution (specific gravity 1.275)(Quinn et.al. 1980), and centrifuged at 2000rpm for 10 minutes. The flotation solution in the centrifuge tubes was "topped off" with more saturated magnesium sulfate solution to form a positive meniscus and was left for 5 minutes. Clean coverslips were touched on the meniscus and then placed on clean microscope slides (5 slides per site) and examined microscopically for the presence of *Toxocara* ova. Each slide was read twice and recorded as positive if Toxocara ova were found. *Toxocara* ova were confirmed using methods described by Gillespie et. al. 1991. No attempts were made to differentiate ova of *Toxocara canis* from those of *Toxocara cati.*

RESULTS

Ova identified as *Toxocara* were recovered from three parks located in two residential zones with high prevalence in the Western (54%), followed by southern (46%) zones respectively (Table 1). The site from which *Toxocara* ova were recovered proved to be of equal or even greater importance than the overall number of ova recovered. Table 2 illustrates the distribution of *Toxocara* ova within the three contaminated parks. High concentration of

Nematode Parasite, *Toxocara spp.*

Recovered *Toxocara* ova were intact and some were embryonated. Other nematode ova observed were Trichuris spp.

TABLE 1 PREVALENCE OF *TOXOCARA* OVA IN THREE PUBLIC PARKS LOCATED IN TWO RESIDENTIAL ZONES IN BIRMINGHAM, ALABAMA

Residential Zones & Parks	Demographic Characteristics	Number of Samples /Park	Number of Ova Observed
NORTH	Predominantly		
Arthur Shores Park	Poor/Middle Class Blacks	3	0
Civil Rights Park		3	0
SOUTH	Middle Class		
Brother Bryan Park	White/Blacks	3	8
Memorial Park		3	15
EAST	Middle Class Blacks		
Downey Park		3	0
Eastlake Park		3	0
WEST	Poor/Middle Class Blacks		
Harrison Park		3	0
John McHon Park		3	27
	TOTAL	**24**	**50**

TABLE 2. PREVALENCE OF *TOXOCARA* OVA IN VARIOUS LOCATIONS WITHIN CONTAMINED PARKS

Site of Collection	No. Ova Recovered
Swings	29
Slides	21
Monkey Bars	0
TOTAL	**50**

DISCUSSION

Recent demonstration of soil contamination with ova of *Toxocara spp.*, along with increased pet population and public awareness of pet related problems indicated the need for this study

(Mahadi and Ali, 1992, Gillespie et. al, 1991, Gillespie. S.H., 2001, Childs, J.E., 1985, Ludlam and Platt, 1989, Uga et. al., 1996, and Woodruff et. al. 1981 (a,b)). In the United States, soil studies were reported from various states, but none were reported from Alabama (Childs, J.E., 1985, Dada and Linquist, 1979, and Paul et.al., 1988). In this study, three public parks located in two residential zones with varying demographic characteristics were found to be contaminated with ova of *Toxocara spp.* (Table 1). *Toxocara* ova were found in soils collected from areas around swings and slides (Table 2). These areas represent major children's play areas where contact with *Toxocara* ova is likely to occur. Humoral immune response to *Toxocara* by non-canid hosts such as man shows linear relationship with the number of ova ingested (Rayes and Lambertucci, 1999). Ocular larva migrans does not exhibit liver trapping of larvae and is associated with low antibody concentrations in the hosts. It is therefore plausible that the low level of ingestion of *Toxocara canis* ova, which may occur in parks, may be an important risk factor for acquisition of ocular toxocariasis (Gillespie. S.H., et.al. 1991). This limited study indicates the need to control visitation of public parks by dogs to reduce the risk of *Toxocara* infection. This study also provides a baseline from which the effect of control measures may be monitored. *Toxocara* ova can remain viable in the soil for more than two years; therefore control of toxocariasis is a long–term commitment (Gillespie et.al 1991). Restrictive signs preventing walking of dogs in parks and playground areas, "poop-scoops" and fencing of play areas have all been proposed to reduce the risk of toxocariasis, but the cost-benefit analysis of these measures is yet to be ascertained. Further studies are needed to establish the seroprevalence of *Toxocara canis* in children and adults living around and utilizing the contaminated parks.

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LITERATURE CITED

Brown, H.W. and Neva, F., 1983. Basic Clinical Parasitology. 5th Ed: 136-138.

Childs, J. E. 1985. The prevalence of *Toxocara* species ova in backyards and gardens of Baltimore, Maryland. Journal Public Health. 75 (9): 1092-1093.

Dada, B.J.O., and Lindquist, W.D. 1979. Prevalence of *Toxocara* eggs in some public grounds and highway rest areas in Kansas. Journal of Helminthology 53: 145-146.

Duwel, D. 1984. The prevalence of *Toxocara* eggs in the sand in children playgrounds in Frankfurt/M. Tropical Medicine And Parasitology. 78(6): 633-636.

Gillespie, S.H. 2001. *Toxocara*: Dogwalking and playing fields. British Journal of Sports Medicine 35(1): 6-7.

Gillespie, S.H., Pereira, M. and Ramsay, A. 1991. The prevalence of *Toxocara canis* ova in soil samples from parks and gardens in the London area. The Society of Public Health 105: 335-339.

Gillespie, S.H., Dinning, W.J., Voller, A., and Crowcroft. N.S., 1993. The spectrum of ocular toxocariasis. Eye 7: 415-418.

Guerra, A., Navarro, C., and Ladron de Guevara, C. 1995. Seroprevalence of toxocariasis in children and a case of VLM. European Journal of Epidemiology 11: 701-702.

Hakim, S.L., Thadassavanth, M., Raden Shamilah, R.H., and Yogeswari, S. 1997. Prevalence of *Toxocara canis* antibody among children with bronchial asthma in Klang Hospital, Malaysia. Transactions Royal Society of Tropical Medicine Hygiene 91:528.

Humbert, P., Niezborala,M., Salembier, R., Aubin, F., Piarroux, R., Buchet, S., and Barale, T. 2000. Skin manifestations associated with toxocariasis: A case control study. Dermatology 201:230-234.

Ludlam, K.E. and Platt, T.R. 1989. The relationship of park maintenance and accessibility to dogs to the presence of *Toxocara* species ova in soil. Journal Public Health. 79(5): 633-634.

Mahdi, N.K. and Ali, H.A. 1992. *Toxocara* eggs in the soil of public places and schools in Basrah, Iraq. Annuals Tropical Medicine And Parasitology 87(2): 201-205.

Nelson, S., Greene, T. and Ernhart, C. 1996. *Toxocara canis* Infection in preschool age children: Risk Factors and Cognitive Development of Preschool Children. Neurotoxicology and Teratology 18 (2): 167-174.

Paul, A.J., Todd, K.S., and Dipietro, J.A. 1988. Environmental Contamination by Eggs of Toxocara Species. Veterinary Parasitology (26): 339-342.

Quinn, R., Smith, H.V., Bruce R.G., and Girdwood, R.W.A. 1980. Studies on The incidence of *Toxocara* and toxocariasis species ova in the environment. A comparison of floatation procedures for recovering *Toxocara* species ova from soil. Journal Hygiene Cambridge 84: 83-89.

Rayes, A. A., and Lambertucci, J.R. 1999. visceral larva migrans and pyogenic liver abscess. American Journal of Gastroenterology 94 (4): 116.

Schmidt, G.D. and Roberts, L.S. 1977. Foundations of Parasitology. The C.V. Mosby Company.

Uga, S., Minami, T., and Nagata, K. 1996. Defecation habits of cats and dogs and contamination by Toxocara eggs in public park and sandpits. American Journal of Tropical Medicine and Hygiene 54 (2): 122-126.

Woodruff, A.W., Aalih, S.Y., DeSavigny, D., Baya, E., and Shahi, A.I. 1981 (a). Toxocariasis in the Sudan. Annuals Tropical Medicine And Parasitology 75(5): 559-561.

Woodruff, A.W., Watson, J., Shikara, I., Azzi, Al N.S.H., Hadithi, T.S., Adhami, Al S.B.H., and Woodruff, P.W. R. 1981 (b). *Toxocara* ova in soil in the Mosul District, Iraq, and their prevalence to public health measures in the Middle East. Annual Tropical Medicine and Parasitology 7(5): 555-557.

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THE DOMESTICATION OF THE DOG IN GENERAL -- AND DOG BURIAL RESEARCH IN THE SOUTHEASTERN UNITED STATES

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ABSTRACT

Several problems concerning the domestication of the dog have challenged anthropologists for decades. The previously accepted views of the dog's origins, method of domestication and approximate evolutionary dates are now being challenged by new scientific methods such as mitochondrial DNA. A much earlier date for the appearance of the dog could provide new approaches to assessing archaeological data. This paper concludes by examining selective dog burials in the southeastern United States and the conclusions of several anthropologists.

There are several problems concerning the domestication of the dog that have challenged anthropologists for many years. It is generally agreed that the dog was the first domesticated animal! Beyond that, there are many disagreements. Some of the problems are these: What date did the dog become domesticated? Did man domesticate the dog or was it a natural evolutionary event by the dog? If the dog is not a domesticated wolf, then where are its fossil remains? Some researchers believe the dog may be descended from a small mutant canid of the Pleistocene era, and that its origins were in Northern or Central Asia. If this theory is true, failure to find fossil remains might be easily explained: most of North America and parts of Asia have been searched, but large expanses of Asia remain virtually unexplored by those researching the origins of the dog. (Dangerfield and Howell 1971:149)

Another view believes that the dog is descended from the wolf. Studies show that the grey wolf and domestic dogs' mitochondrial DNA sequence differs by just 0.2%. This places the DNA of a dog much closer to the wolf than any other member of the genus *Canis*. (Wayne 1993: 218-224; Wayne and Jenks 1991:565-568, SEE: charts, maps and tables). This view is much more widely accepted by researchers but the actual date, method and sequence of change remains an open area of discussion!

Researchers have generally believed that the domestication of the dog took place during a period of 13,000 to 15,000 years ago, a time period that corresponds with the end of the last ice age.

However, the actual fossil record that clearly indicates that domestic dogs lived in association with humans does not extend much beyond 10,000 B.C. Moreover, examples that suggest domestication might have occurred much earlier do exist. Dog bones do exist in kill sites and butcher sites at earlier dates but this does not mean the dogs were domestics working with the hunters. A more controversial example is a cave painting in Spain which portrays a "dog-like" animal apparently participating in the hunt with primitive man. This painting has been estimated to be between 50,000 and 35,000 years old, so if the date is indeed correct and the animal is hunting with the humans, then the dog or near-dog would have been domesticated much earlier. (Dangerfield and Howell 1971:150). The possibility of this early date will be considered separately in reference to the origins of true dogs!

In the Western hemisphere, dog remains have been discovered at very early archaeological sites. Ranging over a large area, these sites include: Agate Basin (Wyoming- c8,000 B.C.); Danger Cave (Utah- c7,000 B.C.); Koster Site (Illinois- 5,000-8,000 B.C.); Eva Site (Tennessee- c5,000 B.C.); Green River Sites (Kentucky- 3,000-4,000 B.C.); Mulberry Creek Site (Alabama-c4000 B.C.); and the Perry Site (Alabama -c3,000 B.C.)
(Schwartz 1997, Fowler 2001). There are two ways domestic dogs might have been introduced into the New World. The early humans who migrated into the Americas most likely brought their domesticated dogs with them. Also, for the last 100,000 years, the grey wolf had extended its range into North America and could have been domesticated here as well. (Lange 2002:8) There is little doubt that this process was repeated many times and at different periods through out the world!

Before looking at the Southeast and Alabama specifically, the meaning of domestication should be carefully examined. One could say that domestication of animals means casting one's life with that of humans. For example, one can tame a lion but it does not become domestic. It will still turn on its master, kill the master's dogs or livestock and it will not herd sheep or be dependable for other work. When two tamed lions are mated in captivity, the resulting cubs must still be tamed or trained. Likewise, the canary has been a cage bird for centuries--hundreds of canary generations-- and yet it is not a domestic bird. Horses, turned loose by Spanish explorers in America, became wild, but once captured after three centuries, quickly reverted to their domestic life, perhaps part of a genetic makeup as a response to humans. It is thus evident that no single species became domesticated within the life span or even in several life spans of man. A major complication in the study of our domestic animals--including the dog--is that they were domesticated before recorded history began. In the end, we do not understand the processes, how it began, nor even when it occurred. There are several theories that we should examine for the domestication of the dog. (Dangerfield and Howell 1971: 149-50).

(1) Primitive man was a hunter. Perhaps bringing home wolf cubs (after killing a bitch wolf) resulted in the cubs later joining the hunters. The love of the chase would be genetically imprinted on their brain but the smell of man upon them repulsed their fellow wild wolves. They gradually accepted man as master, companion and protector. In the Southeastern United States, some researchers, John R. Swanton for example, again differ on the dog as a hunter-companion. He did not believe the dog was used extensively in hunting. (Swanton 1946: 324) Another researcher, however believes that dogs were utilized for hunting solitary animals like bear, deer or rabbits, rather than herd animals. (Driver 1969:87). One eighteenth century witness provided an interesting observation when he described "...crafty hunting dogs...biting and gnawing the hams of bears until

(2) Man's garbage heaps tantalized the first true dogs. It was easier to scavenge the settlement than to hunt. Man may have encouraged them and made offers of friendship. The dogs soon served double duty. They cleaned up the garbage and gave warnings of danger by barking. Studies in New Guinea show that villages with no dogs had to move to avoid stench, flies and garbage while those villages with scavenging dogs had semi-permanent villages.(Dangerfield and Howell 1971:150).

(3) Man simply domesticated dogs as a beast of burden. Primitive man first learned to use his hands and then made tools, woven baskets, and ceramic pottery. Later, turning to transportation, man transferred the load of carrying pelts, firewood and food from his back to that of the dog or other animals. The dog was used in many places to pull a travois or sledge. This theory is supported by a sledge found in Northern Europe dating to c.6,000 B.C.(Derr 2000, Dangerfield and Howell 1971:150)

(4) Another theory believes that dogs may have been domesticated for use as food. While most developing cultures eventually abandoned this practice in favor of their dogs as pets, hunting partners or beasts of burden, lesser developed people continued the practice. The Aztec and other South and Central American peoples relied on dog meat for their animal protein requirements. Various chronicles of the Hernando De Soto expedition in the Southeastern United States contains references to rather small but numerous dogs in Indian villages that they visited. Not only did the Indians eat them, but they offered them to the Spanish who apparently feasted upon them. After overcoming the cultural bias, the members of the Lewis and Clark Expedition, as did many explorers, lived on dog meat for months.(Derr 2000) But, in the Southeastern United States there are later contradictions to the use of dogs as food in the contemporary accounts of both William Bartram and James Adair who lived and traveled among the eighteenth century Indians. (Adair 1968:133-134; Bartram 1853:49-50). In addition, one chronicler of the De Soto expedition, the Gentleman of Elvas, wrote that the Southeastern Indians did not eat dogs because there was an abundance of meat. (Smith 1968:55;68, Bourne 1904:72;103)). Other writers mention the use of dogs as food in only rare ceremonial events. (Romans 1775:100; Swanton 1946:251).

(5) Many scientists believe that all domestic animals, including the dog, were first domesticated for purposes of divination and religious symbolism. Some cultures even utilized the dog as a guide or companion for the arduous journey to the afterlife. (Derr 2000; Dangerfield and Howell 1971:151).

(6) Professor William J. Haag of the Department of Anthropology, University of Kentucky, believed that dogs descended from an unknown small mutant canid of the Pleistocene era. At a time when mammals generally were rapidly increasing in size, the smaller size would make life more difficult for this canid mutant. It might have also made it more fearful, and at the same time, more servile. An inherent servility might have prepared it for domestication. (Dangerfield and Howell 1971: 150-151). Most researchers accept that canids began to distinguish themselves from other mammalian carnivores about 50 to 60 million years ago. Known as miacids, a ferret-like fox-sized creature, they evolved through various stages into Canis Epicyon about eight million years ago--believed to be the ancestor of wolves and foxes. Haag's idea is seriously challenged by new studies on the wolf and dog relationship in the laboratories of Robert K. Wayne. Wayne, Caries Vila and other researchers, again using mitochondrial DNA, believe that the split between dogs and wolves may have occurred as early as 135,000 years ago. Wayne and his researchers point out that the failure of dogs to appear before

about 14,000 years ago in fossil records is because they looked, for the most part, like wolves before then. (Vila, et al 1997:1689; Lange 2002:8). If this is true, domestication could have commenced at about the same time as humans' own recent evolution as a species--and perhaps not much after the acquisition of language. (Derr 2000).

Whatever theory one might favor, domestication would not have come quickly. Over thousands of years, the dog probably watched and studied man; and finally worked out some relationship with him. Dogs ate garbage, attached themselves to the village, barked out warnings and perhaps even sought safety there from their own enemies. As they moved closer to the warming fires, dogs must have realized that both they and man had common enemies, and came to accept man as ally, guardian and master. Adaption was probably a slow process as the dog learned not to kill other domesticated animals belonging to man. Dogs also had to adjust to living in all areas of the world and to adapt to man's varying food habits. This process has not stopped. Dogs now live in high-rise apartments, ride on spacecraft, guide the blind and search for drugs and missing people. (Dangerfield and Howell 1971: 151)

To the Indian, the domesticated dog was a hunting partner, pack animal, food source, camp guard, and guide to the afterlife--but more importantly became a loyal and trusted companion. During archaeological excavations, evidence of this affection for the dog should be recorded and studied as closely as flora and fauna, stones and bones, and pottery and artifacts. The relationship and position of the dog to the culture they lived in tells us much about the compassion and inner-feelings of the those human ancestors--our human ancestors! This information does already exist. It can be found in the notes, papers and photographs from excavations in the Southeast in general and Alabama in particular. A brief examination of some of those records from some selected sites are in order.

David L. DeJarnette in 1958 wrote that dog burials, which accompanied human burials, provided evidence of either ceremonial use or an intimate personal regard for the dog. He wrote that to archaeologists this should be evidence of full domestication of the dog. (Dejarnette 1958: 22). At the Mulberry Creek site in the Tennessee River basin in Colbert County, Alabama, two dog burials were located with burial 88, one at the knees and one at the head. Fifteen dog burials, some in a Morrow Mountain association were found in the Three Mile component at the Eva site. These sites fall in a range of about 5,200-4,300, plus or minus 500, B.C. No conclusions were made as to whether these dog burials were ceremonial, religious or companion burials. (Walthall 1980: 64-65)

Charles Hudson wrote that skeletons of rather large dogs--possibly hunting dogs--were discovered at the Eva site. In addition to carefully arranged burials of Archaic human adults and children, he mentioned that about one third of the burials included such materials as red ocher, weapons, tools and the bodies of dogs. (Hudson 1976: 51-55)

Middle Archaic man in Alabama leaves some of the earliest dog burials which are described as "though they were someone's best friend." (Griffin 1967:178). This view is supported by excavations at Russell Cave. Carl F. Miller wrote that it is accepted that (domesticated) dogs were scarce in Archaic times and highly valued as hunters. A small dog buried with a broken stone blade at Russell Cave had been given a "much more careful burial than the man". Its tomb, built with a stone base and slab sides to protect its body, indicated a token of affection. (Miller 1956: 556).

Multiple burials of dogs have been recorded at many archaeological sites during the various stages of aboriginal development in Alabama. For example, two dog burials lying extended on their right sides with their heads to the West were found in the stone floor of the Mississipian era ceremonial mound at the Bessemer site in Jefferson County, Alabama. (DeJarnette and Wimberly

1940; 22-23). An example of the Woodland era can be seen in five dog burials accompanying twelve human burials in the McLeod phase at James Village site in Clarke County, Alabama. (Walthall 1980:168). Finally, the archaeologist should also be aware that other forms of information can be derived from the examinations of dog burials. Archaeologist David Chase noted that in seven dog burials excavated at an Alabama prehistoric Indian village, two of the dogs had a pathological bone disease known as hyperpulmonary osteoarthropathy. One dog had obviously been killed, in perhaps a mercy killing, by having its skull crushed. This discovery was important because the disease is rather rare, but has continued as an active disease in more recent times in the same area of Alabama where the dog burials were found. Veterinarians have since discovered that the highest incidence of this disease is Central Alabama--specifically Lee and Macon Counties--just a few miles from the site of the prehistoric dog burials. It is likely that the disease has persisted in that area since prehistoric times. (Brennan 1973:129)

Dog burials are more than just odditics or objects of curiosity at excavation sites. Their pathological development can be just as important as discovering the impact of disease on aboriginal peoples or what flora and fauna can be found in refuge pits. Studies of the size of the skeletons, diseases of bones, or burial circumstances can help us understand the occupational roles of the dogs; their comfort level with humans; and their status at the time of their death. By reversing that information, we can learn more about the humans who lived with and beside them in villages, forests, travels and hunts. In reality, because of the dog's unusual status with humans for the past centurics, "Man's Best Friend" might tell us almost as much about man as his tools, pottery and weapons.

REFERENCES CITED

Adair, James, 1968 *The History of the American Indian, 1775.* Johnson reprint Co., New York

Bartram, William, 1853 Observations on the Creek and Cherokee Indians, 1789. *Transactions of the American Ethnological Society* 3 vols.

Bourne, Edward Gaylord, 1904 *Narratives of the Career of Hernando De Soto.* 2 vols. A. S. Barnes and Co. New York.

Brennan, Louis A., 1973 *Beginners Guide To Archaeology.* Stackpole Press, Harrisburg.

Budiansky, Stephen, 1999 The Truth About Dogs--99.07. *Atlantic Monthly* 284 (7):39-53.

DeJarnette, David L., 1958 An Anthropological Study of a Site Suggested as the Location of Coosa Visited by Hernando De Soto in 1540. *Thesis* The University of Alabama Press, University.

DeJarnette, David L. and Wimberly, S. B., 1941 The Bessemer Site: Excavation of Three Mounds and Surrounding Village Near Bessemer, Alabama. *University Geological Survey Of Alabama Museum*: Paper, No. 17.

Dangerfield, Ed and Howell, Elsworth, 1971 *The International Encyclopedia of Dogs.* Howell Book House, New York.

Derr, Mark, 2000 Dogs and Humans are Seen as Partners in Evolution. *New York Times* 4 April 2000.

Driver, Harold, 1969 *Indians of North America.* University of Chicago, Chicago.

Fowler, Bill, 2001 Origin of Prehistoric Dogs in Alabama and the New World, *Alabama Archaeological Society Stones and Bones*, 43 (8-10)

Griffin, J.B., 1967 Eastern North American Archaeology: A Summary. *Science* 156:175-191.

Hudson, Charles, 1976 *The Southeastern Indians.* The University of Tennessee Press, Knoxville.

Lange, Karen E., 2002 Wolf to Woof: The Evolution of Dogs. *National Geographic* 201 (1): 2-11.

Miller, Carl F., 1956 Life 8,000 Years Ago in an Alabama Cave. *National Geographic Magazine* 150 (10): 542-558.

Romans, Bernard, A Concise Natural History of East and West Florida. 1775; Reprint 1968. University of Florida Press, Gainesville.

Smith, Buckingham, trans.1968 *Narratives of De Soto in the Conquest of Florida As Told by a Gentleman of Elvas and In Relation By Luys Hernandez de Biedman.* University of Florida Press, Gainesville.

Schwartz, Marion, 1997 *A History of Dogs in the Early Americas.* Yale University, New Haven.

Swanton, John R., 1946 *The Indians of the Southeastern United States.* Bureau of American Ethnology Bulletin, No. 137, Washington, D.C.

Vila, Caric, Peter Savolainen, Jesse E. Maldonado, Isabel R Amorim, John E. Rice, Rodney L. Honeycutt, Keith A. Crandall, Joakim Lundeberg, and Robert K. Wayne, 1997 Multiple and Ancient Origins of the Domestic Dog. *Science* 276 (6): 1687-1689.

Walthall, John A., 1980 *Prehistoric Indians of the Southeast: Archaeology of Alabama and the Middle South.* The University of Alabama Press, University.

Wayne, Robert K., 1993 Molecular Evolution of the Family Dog. *Trends in Genetics* 9:218-224.

Wayne, Robert K. and Jenks, S.M., 1991 Mitochondrial DNA Analysis Implying Extensive Hybridization of the Endangered Red Wolf, Canis Rufus. *Nature* 351:565-568.

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SEASONAL PREVALENCE OF TWO LARVAL TREMATODES OF *PHYSELLA GYRINA* IN A SPRING IN NORTHWESTERN ALABAMA

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ABSTRACT

From June 1993 to November 1994, 20 to 30 *Physella gyrina* were collected monthly from four sites within King Spring Wildlife Sancturay, a spring in Northwestern Alabama, and were examined for the presence of larval trematodes. Two species of larval trematodes, *Notocotylus* sp and *Ocetosoma* sp., were found to infect *P. gyrina*. There was a distinct seasonality in prevalence of infection for both parasite species. *Ochetosoma* sp. reached peak prevalences during the fall months, whereas *Notocotylus* sp. Occurred during those months of the study that *Ochetosoma* sp. was virtually absent from *P. gyrina*. Data on mean shell length of collected snails revealed that *P. gyrina* is an annual species, with a new reproductive cohort appearing during the late summer. Some of the trends in parasite prevalence can be explained by changes in the population structure of *P. gyrina*. However, it is likely that a natural beaver dam constructed soon after initiation of the study is altering flow of water through King Spring, and may be affecting trematode dynamics in the snail host.

INTRODUCTION

Much of the literature on snails that serve as hosts for trematode parasites is in the form of life cycle descriptions for the definitive hosts of the parasites. Snails are mentioned simply as intermediate hosts for a particular species of parasite. Recently, however, there has been an emphasis on examining the ecology of larval trematode infection dynamics in the molluscan intermediate host as a means of further understanding this host-parasite relationship (e.g. Aho et al. 1982; Camp et al., 1982; Crews and Esch 1989; Fernandez and Esch, 1991a, 1991b; Williams and Esch, 1991). Moreover, most of the previous studies examined parasite faunas in pond communities, with few studies focusing on stream communities.

During the spring of 1993, preliminary observations of the snail fauna in a spring in northwest Alabama revealed that at least two species of larval trematodes were present. Because nothing was known about the snail and parasite populations within this stream community, a study was undertaken to examine the seasonal dynamics of larval trematodes infecting *Physella gyrina*.

MATERIALS AND METHODS

Study area

King Spring Wildlife Sanctuary (KSWS) is a naturally occurring spring within the city limits of Florence, Alabama. The source of water in the spring is a deep, underground channel in underlying limestone bedrock at the north end of the Sanctuary. The water in the spring flows at a rate of approximately 900 gallons/minute with minimal seasonal fluctuation (Kittle, 1993). At the headwaters, water flow is minimal, and as a result, a large population of the pulmonate snail, *Physella gyrina*, is present. As the spring narrows and water flow increases, the density of *P. gyrina* declines to the point at which the snail is rarely found in the fastest flowing parts of the spring (A. Crews-Oyen, pers. observ.). *Elimia paupercula* is the only other species of snail that inhabits KSWS. At the beginning of the present study, the distribution of *E. paupercula* was confined to the fastest flowing waters of the spring, but as the study progressed, *E. paupercula* was observed in increasing density towards the headwaters of KSWS.

Seasonal dynamics of larval trematodes

Twenty-five to thirty *Physella gyrina* were hand-picked from the vegetation and bottom of each of four collection sites in KSWS every 4 wk from 1 June 1993 to 20 November 1994. Snails were transported to the laboratory and isolated individually in 24-well tissue culture plates containing water from the spring. Housed snails were held in a constant temperature chamber that simulated photoperiod and water temperature at the time of collection. Snails were maintained for three days before wells were examined for cercariae. Snail shell length was measured with a vernier caliper to the nearest 0.05 mm. Those snails not shedding cercariae were crushed and examined for intramolluscan stages.

Data analysis

Statistical analyses were performed with SAS (Statistical Analysis Systems Institute, Cary, North Carolina). Mean values and S.E.M. values for snail shell length were computed using the PROC SUMMARY procedure; mean comparisons were performed using Least Square Means (LS Means) option of PROC GLM. Means were considered significantly different at $P \leq 0.05$.

RESULTS

Monthly water temperatures

Surface water temperatures were measured monthly at all 4 sites in KSWS beginning in June 1993 and continuing through November 1994 (Fig. 1). Overall, KSWS maintained a surface water temperature between 16°C and 18°C. There was one exception that occurred in site 1 during the first four months of the study. Here, the surface temperature at site 1 was consistently higher than the other three sites. Minimum surface water temperatures were observed at site 4 in November 1993 (13°C) and at sites 1 and 3 in December 1993 (14°C).

Seasonal changes in larval trematodes

From a total of 2,469 *P. gyrina* collected in KSWS, 300 (12.1%) were infected with single species infections of two different larval trematodes. The two larval trematode species present in *P. gyrina* were identified as *Notocotylus* sp., which infected 164 (6.6%) snails, and *Ochetosoma* sp., which was found in 136 (5.5%) snails. Only one double infection was observed: a 10.1 mm snail from site 3 in the March 1994 collection was infected with larval stages of *Notocotylus* sp. and *Ochetosoma* sp. Although several collections of *E. paupercula* were also made, none of these snails was infected with larval trematodes. Therefore, the study focused upon the parasites of *P. gyrina*.

When monthly prevalence data are examined, there are distinct seasonal trends for both species of larval trematode. A peak prevalence of 28.8% was observed during June 1993 at site 1 for *Ochetosoma* sp. Following this peak, there was an overall decline in prevalence until January 1994, at which time no larval *Ochetosoma* sp. was found in snails (Fig. 2). Monthly prevalence data remained at 0% from January to June of 1994, then was between 5 and 10% for the rest of the study. Site 2 showed a different pattern, with peaks in prevalence from September 1993 (12.5%) through December 1993 (12.1%) , a decline from January 1994 to June 1994, and a prevalence of 0% during the remainder of the study. Site 3 and site 4 showed a pattern similar to site 1, with a peak in prevalence during July and August 1993 to early fall, a decline during November 1993 to May 1994, and a rise in prevalence during June and July 1994.

Seasonal patterns for *Notocotylus* sp. showed a much different pattern than that observed for *Ochetosoma* sp. (Fig. 3). Here, peak prevalences occurred during January through May 1994 in sites 1, 2, and 4, with low prevalences recorded during the rest of the study. From June through October of 1993, there were no larval stages of *Notocotylus* sp. found in *P. gyrina* at sites 2, 3 and 4.

Population structure of *P. gyrina*

The mean length of *P. gyrina* varied both seasonally and spatially. In site 1, the mean length peaked in July 1993 at 10.69 mm, and then declined to 7.20 mm in November (Fig. 4). A second peak of 10.04 mm occurred in April of 1994. Mean snail length declined through September and remained unchanged for the remainder of the study. Site 2 showed a slightly different trend, with a peak in mean length in July of 1993 at 8.94 mm, followed by a decline during the early winter months. Another peak of 9.90 mm was observed during the second season in April, with a decline to 5.24 mm in August 1994. Site 3 was much the same, with a peak in mean length of 10.13 mm in June of 1993, a low of 7.39 mm in November 1993, another peak of 11.38 mm in April 1994, and a declining mean length for the remainder of the study.

Site 4 showed little overall change in snail length over the course of the study. The greatest mean length at site 4 occurred in June 1993 at 7.40 mm, whereas the smallest mean length recorded was 4.45 mm in October 1994. Moreover, the mean shell length of *P. gyrina* was consistently smaller at site 4 than any other collection site during most of the study.

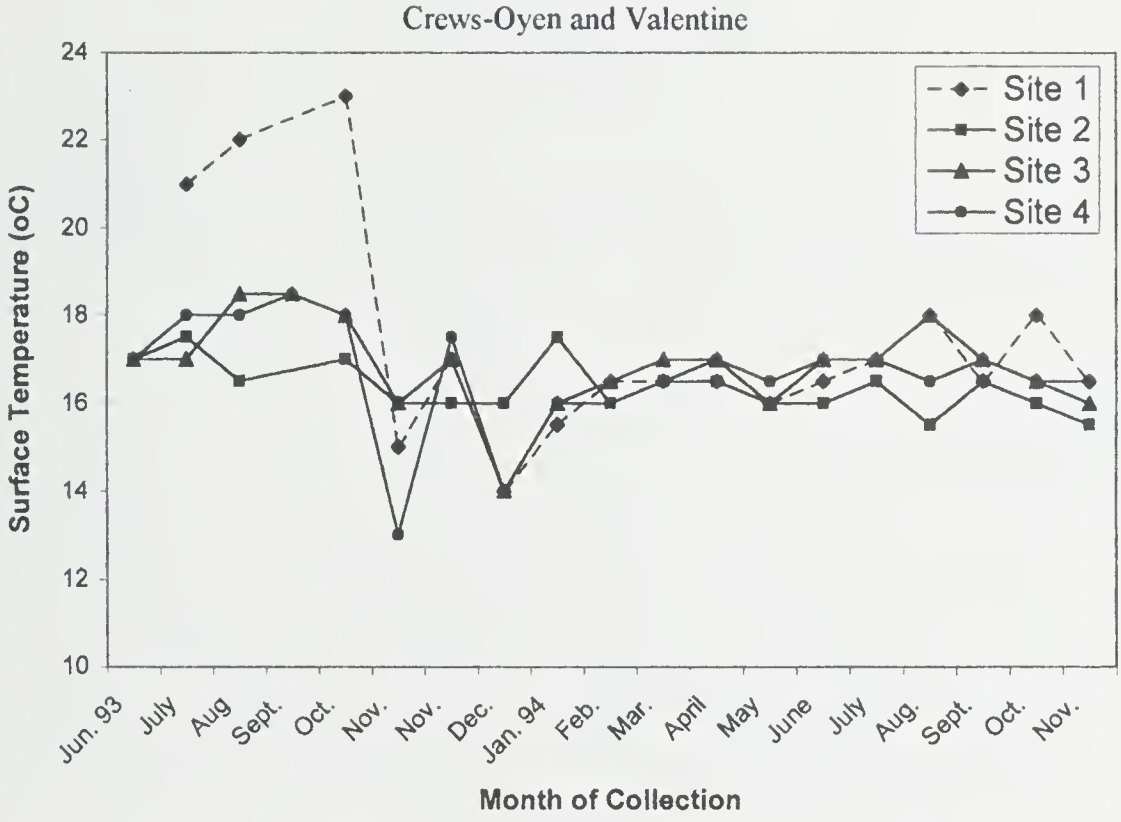

Figure 1. Monthly surface water temperatures at four collection sites within King Spring Wildlife Sanctuary.

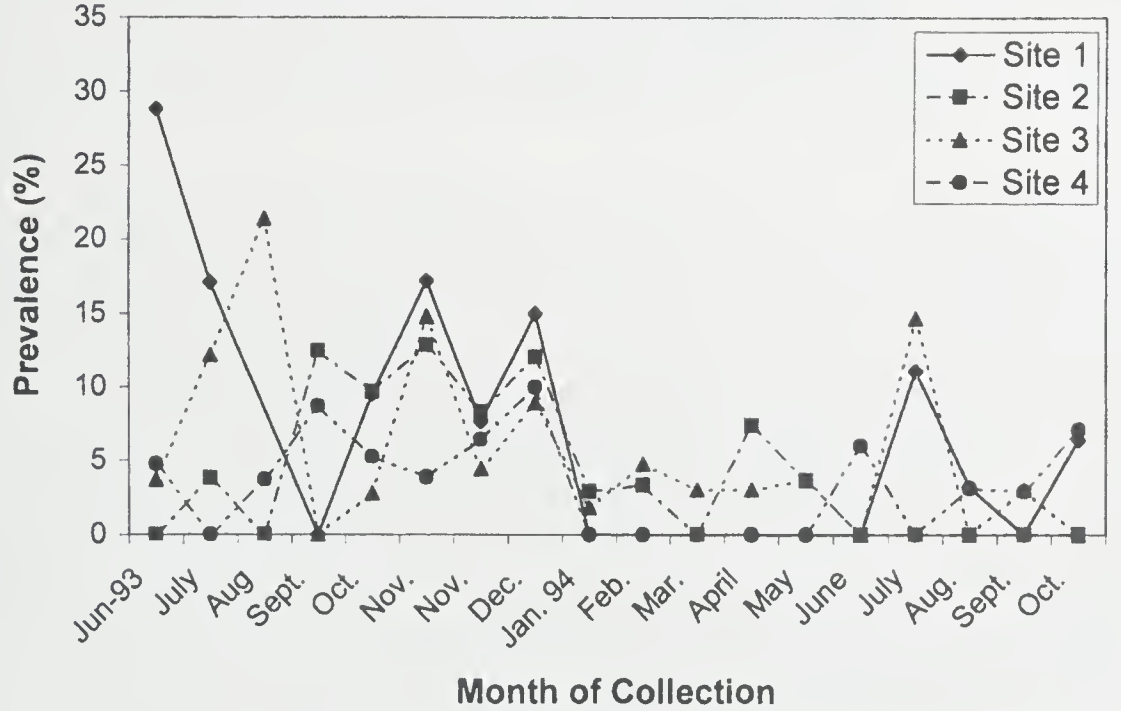

Figure 2. Prevalence of *Ochetosoma* sp. in Physella *gyrina* from four collection sites within King Spring Wildlife Sanctuary. Data represent percentage of snails infected with *Ochetosoma* sp.

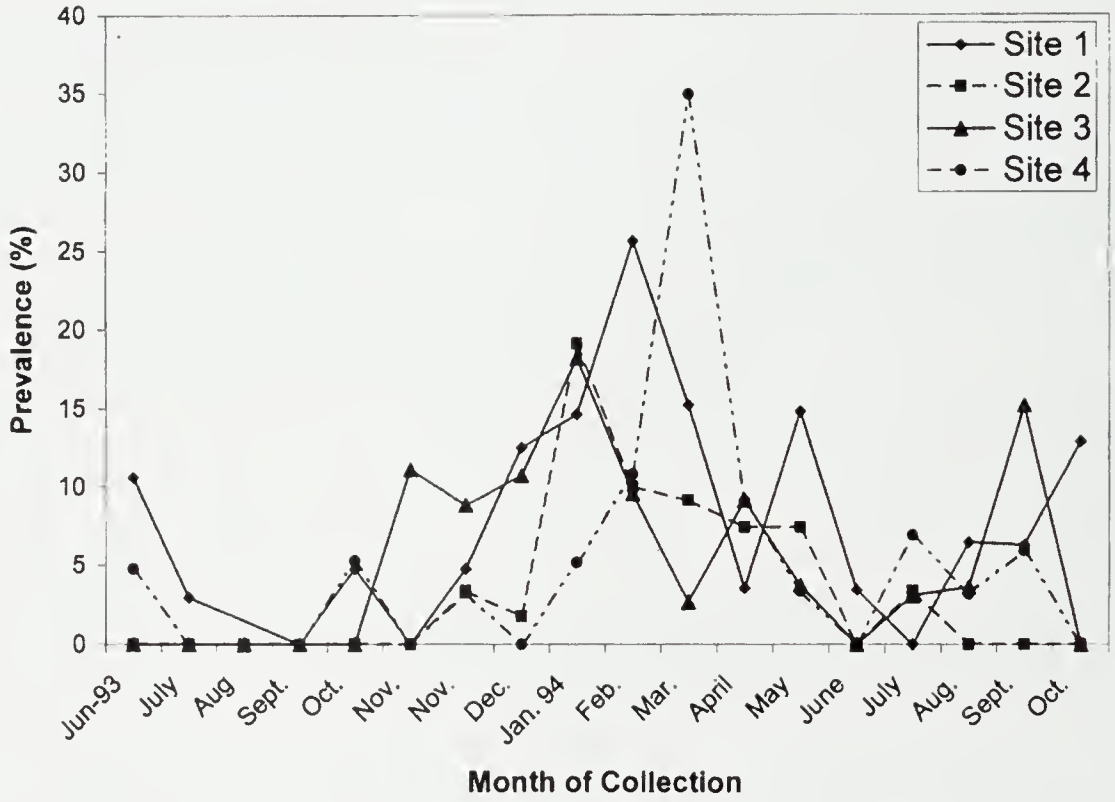

Figure 3. Prevalence of *Notocotylus* sp. in *Physella gyrina* from four collection sites within King Spring Wildlife Sanctuary. Data represent percentage of snails infected with *Notocotylus* sp.

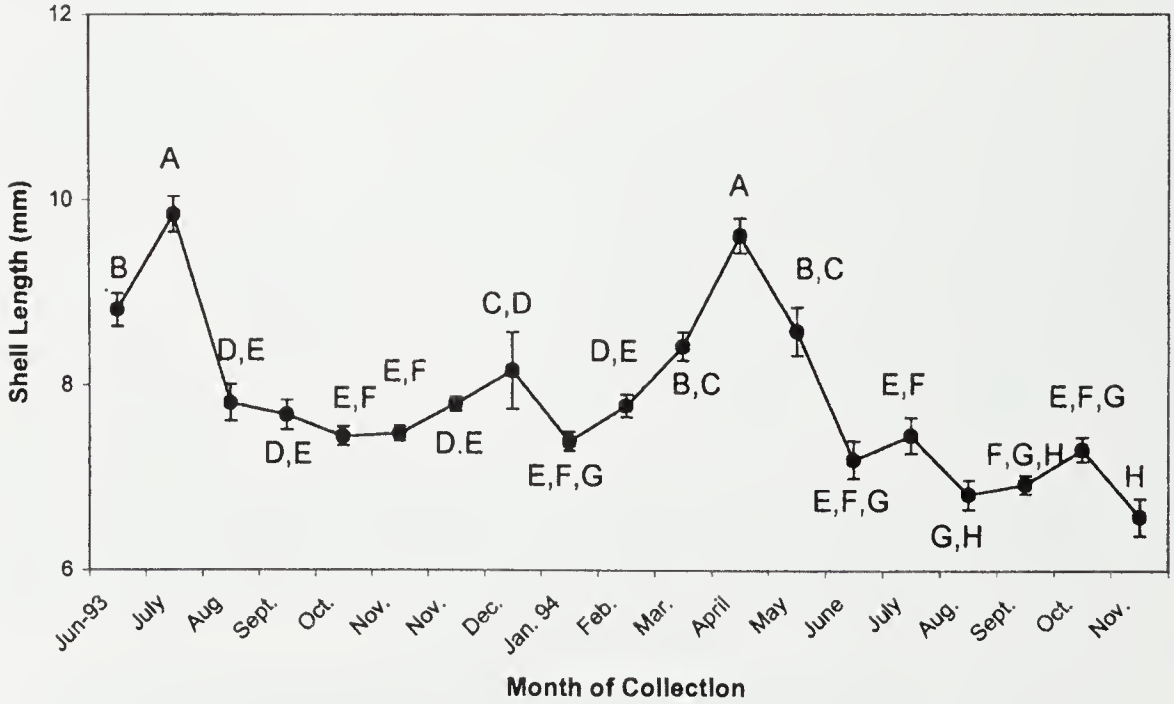

Figure 4. Mean shell length (mm) of *Physella gyrina* collected at monthly intervals from four sites within King Spring Wildlife Sanctuary. Data are mean ± S. E. M.

DISCUSSION

The overall prevalence of *Ochetosoma* sp. and *Notocotylus* sp. in *P. gyrina* from KSWS was approximately 6%, which is consistent with percentages observed with other larval trematodes in other gastropod intermediate hosts (Lemly and Esch, 1984; Crews and Esch, 1986). Although the overall prevalence of both larval trematode species was similar, there were clear seasonal changes in prevalence at the four collection sites.

Peak prevalences of *Ochetosoma* sp. larval stages occurred during the fall to early winter. The lowest prevalence values were observed during the months of January to May at sites 1, 3, and 4. These data fit well with published accounts of experimental infections of *Ochetosoma* sp. (Byrd, 1935), which describe snakes as the definitive host and tadpoles and frogs as second intermediate hosts. Therefore, snails became infected during summer and possess patent infections during the late summer and early fall. The pre-patent period in snails is between 30 and 40 days at room temperature (Byrd, 1935), but would likely be prolonged due to the cooler ambient water temperatures in KSWS. Since the cercariae penetrate their second intermediate host, it is conceivable that this larval trematode may overwinter as metacercariae in the frog host. Prevalence of *Ochetosoma* sp. in snails dropped to zero in three of the four collection sites during the months of January to June. The lack of infected snails indicates that no recruitment is occurring in snails during the winter and early spring months because the snake definitive host is not active at lower ambient temperatures

Seasonal changes in prevalence of *Notocotylus* sp. are nearly the opposite of *Ochetosoma* sp. Peak prevalences of infection were observed in January through May in sites 1, 2, and 4, with site 3 showing a peak in prevalence occurring earlier, November through April. The definitive host for *Notocotylus* sp. is wild waterfowl; wood ducks have been observed during the spring in KSWS (P.D. Kittle, pers. comm.) It is in the later months that the wood duck is present to acquire the infection via ingestion of metacercariae on vegetation. These metacercariae have been shown to be fully infective soon after encystment (Herber, 1942).

Changes in snail length in all four sites is most likely due to changes in the seasonal population dynamics of the snail. Snails grew rapidly during the spring months of March and April. Subsequently, there was a decline in mean shell length during the months of May, June, and July. This decline suggests a "dilution" effect created by a new reproductive cohort coupled with an increased mortality of larger snails. The exception to this trend was seen in site 4, which showed little seasonal change in mean shell length. Moreover, snails at site 4 were consistently smaller than snails collected at the other sites. There are two related hypotheses that could explain the unique results of site 4. First, site 4 is located in a portion of the spring in which water flow appears faster than at the other three sites. It is likely that these snails represent a subset of the original population that remained behind after snails larger than about 7.5 mm were washed downstream. Larger snails may not be able to maintain a foothold on the substrate because of water flow and were subsequently taken away with the current. This situation was probably magnified by the construction of a natural beaver dam several months after the initiation of this study. This dam, located just upstream from site 4, grew in size over the course of the study. The result was an increase in local water flow out of and over the dam that increases water flow at the collection site.

The presence of the beaver dam in an otherwise fast-flowing stream has created several major changes in the ecology of KSWS. One of the most significant changes was in

the depth and flow of water at all four collection sites. At the beginning of the study, water levels fluctuated greatly, depending primarily on the amount of rainfall received. With the construction of the beaver dam, water depth has increased dramatically at sites 1, 2, and 3. During several of the collection sites, water depth was estimated at nearly one meter, whereas water depths before construction of the dam were no more than 1/3 meter. Moreover, the dam has changed the upper portion of KSWS into more of a "pond-like" environment with greater water depths and a concomitant reduction in water flow past the first three sites. What effect this dam has upon seasonal trends in prevalence of *Notocotylus* sp. and *Ochetosoma* sp. over the long term remains to be seen.

In conclusion, changes in overall prevalence of two species of larval trematodes from KSWS correspond more with host availability that with the seasonal changes in the snail host population. *Ochetosoma*, one of two larval trematode species found to infect *P. gyrina*, was more of a fall to early winter parasite, whereas *Notocotylus* was more of a spring to early summer parasite. This seasonal resource partitioning of the snail intermediate host may explain the lack of double infections observed in *P. gyrina*.

ACKNOWLEDGMENTS

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LITERATURE CITED

Bryd, E. E. 1942. Life history studies of Reniferinae (Trematoda, Digenea) parasitic in reptilia of the New Orleans area. Transactions of the American Microscopical Society 54: 196-225.

Crews, A. E. and G. W. Esch. 1986. Seasonal dynamics of Halipegus occidualis (Trematoda: Hemiuridae) in Helisoma anceps and its impact on fecundity of the snail host. Journal of Parasitology 72: 646-651.

Fernandez, J. and G. W. Esch. 1991a. Guild structure of larval trematodes in the snail Helisoma anceps: patterns and processes at the individual host level. Journal of Parasitology 80: 528-539.

Fernandez, J. and G. W. Esch. 1991b. The component community structure of larval trematodes in the pulmonate snail Helisoma anceps. Journal of Parasitology 80: 540-550.

Herber, E. C. 1942. Life history studies on two trematodes of the subfamily Notocotylinae. Journal of Parasitology 28: 179-196.

Kittle, P.D. 1993. King Spring Nature Trail. A project of the Shoals Audubon Society, University of North Alabama Biology Department, and Florence-Lauderdale Industrial Expansion Committee.

Lemly, A. D. and G. W. Esch. 1984. Population biology of the trematode Uvulifer ambloplitis (Hughes, 1927) in the snail intermediate host, Helisoma trivolvis. Journal of Parasitology 70: 461-465.

Williams, J. A. and G. W. Esch. 1991. Infra- and component community dynamics in the pulmonate snail, Helisoma anceps, with special emphasis on the hemiurid trematode, Halipegus occidualis. Journal of Parasitology 77: 246-253.

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TOLBERT FARM: A PALEO-EARLY ARCHAIC SITE COMPLEX NEAR JACKSONVILLE, ALABAMA

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ABSTRACT

The Tolbert Farm Complex is located along a tributary branch of Tallasseehatchee Creek. These sites are of interest for two reasons: (1) the diversity and density of Paleoindian/Early Archaic bifaces recovered from the complex as compared to other regional archaic sites; and (2) the fact that these sites lie nearly twenty miles east of the Coosa River along a small tributary branch. The geographical location of the Tolbert Farm Complex along Little Tallassechatchee Creek, whose headwaters originate in Whites Gap providing a major east-west entry across Choccolocco Mountain, may explain the presence of this prolific early site complex and similar Paleoindian/Early Archaic sites located in the vicinity of Whites Gap and nearby Bains Gap.

INTRODUCTION

The Tolbert Farm Site Complex is situated along Little Tallasseehatchee Creek, a tributary of Tallasseehatchee Creek located just southwest of the city of Jacksonville, Alabama. Six multicomponent archaeological sites along this tributary have yielded a substantial number of diagnostic bifaces indicating a Late Paleoindian/Early Archaic cultural presence: 1Ca201, 1Ca202, 1Ca203, 1Ca204, 1Ca205 and 1Ca295. The Tolbert Farm Complex lies near the headwaters of Little Tallasseehatchee Creek, which originate in Whites Gap providing a major east-west corridor across Choccolocco Mountain. Whites Gap and Bains Gap, which lies six miles to the south, are the only two major crossing points along Choccolocco Mountain.

Choccolocco Mountain is basically a northeast-southwest trending ridge, which begins in the north near Piedmont, Alabama and runs in a southwesterly direction for over 30 miles terminating near Oxford, Alabama. This mountain range, averaging over 1000 feet above the surrounding valleys, presents a formidable barrier to east-west human population movements (Holstein and Little 1982). Whites Gap, lying approximately in the middle of the

Choccolocco Mountain, provides a major east-west point into Choccolocco Valley and to the greenstone along the eastern side of this valley. The Tolbert Farm Complex property lying just west of Whites Gap is at the base of Choccolocco Mountain and along Little Tallassehatchee Creek. These archaeological sites are situated directly in what would have been the logical path of the earliest east-west moving aboriginal population utilizing Whites Gap. Based on the presence of Paleoindian bifaces, it appears this east-west route was first utilized in late Pleistocene times (circa 9,000 BC).

Temporal placement of the Paleoindian period at 10,500-8000 BC, Early Archaic period at 8000-6000 BC, Middle Archaic at 6000-4000 BC, Late Archaic at 4000-700 BC, Early Woodland at 700-100 BC, Middle Woodland at 100 BC- AD 500, Late Woodland at AD 500-AD 1150, and Mississippian at AD 1150-1550 has been established by radiocarbon dates and stratigraphic relationships from Dust Cave in Northwest Alabama (Driskell 1994), Russell Cave in northeastern Alabama (Griffin 1974), and Stanfield-Worley Bluff Shelter in northern Alabama (DeJarnette, et.al. 1973).

NATURAL SETTING

The Tolbert Farm Complex lies approximately one mile southwest of Jacksonville, Alabama, along both banks of Little Tallasseehatchee Creek (see Figure 1). The complex is located in the Valley and Ridge Physiographic Province within the Weisner Ridge District, which separates the Coosa Valley District from the Piedmont Physiographic Province. Choccolocco Mountain represents the most easterly mountain ridge of the Ridge and Valley Province (Harlin, et. al. 1961). The Piedmont Physiographic Province begins on the eastern margin of Choccolocco Valley approximately seven miles east of the Tolbert Complex.

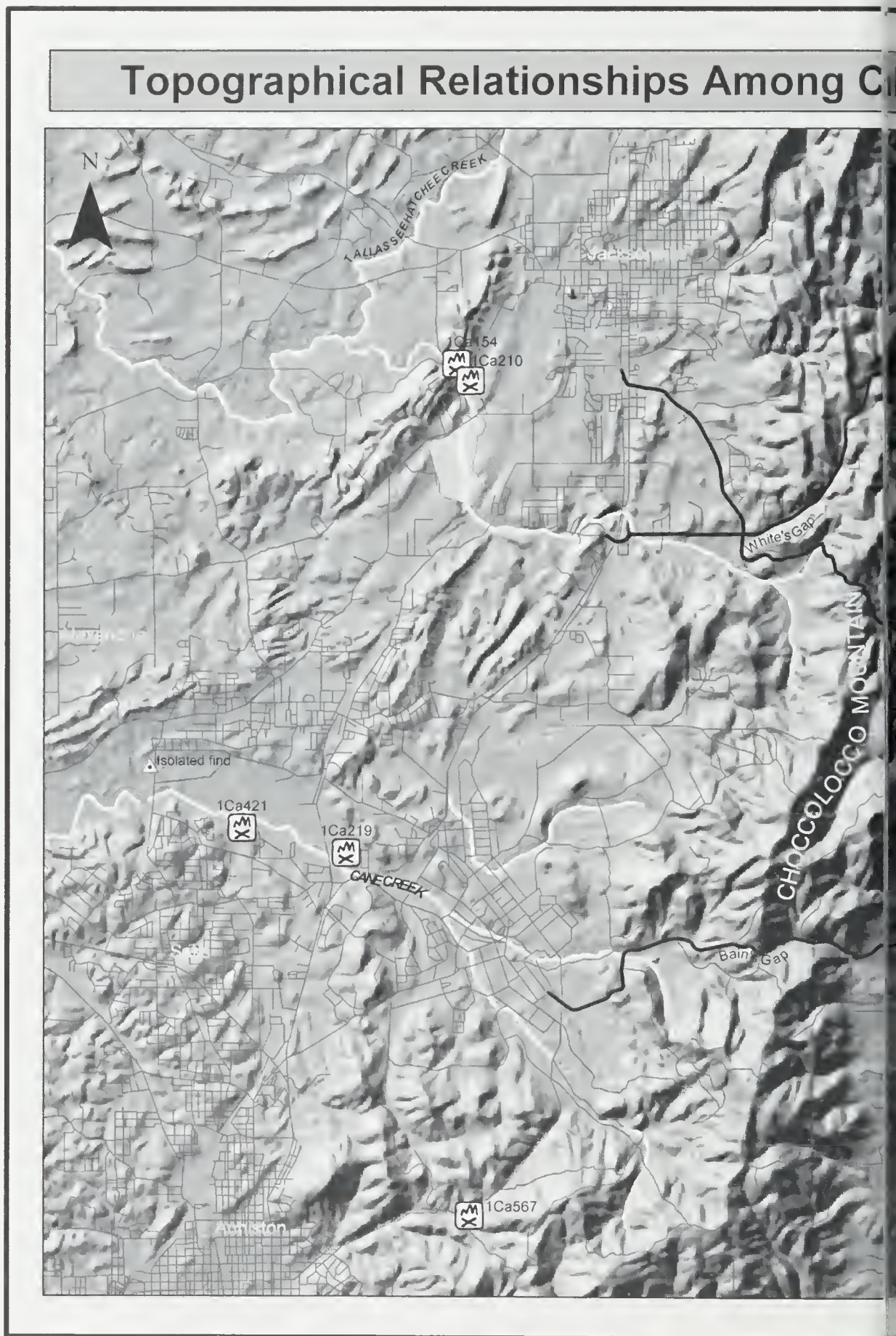
The district is characterized by steep ridges and rugged mountain topography. The area's strong relief is typified by Choccolocco Mountain whose 1800-foot elevation towers over the 700-foot floor of Choccolocco Valley. Whites Gap begins just southeast of Jacksonville. As the gap cuts through Choccolocco Mountain it forms two forks that exit out into Choccolocco Valley along the eastern side of Choccolocco Mountain. Today, Whites Gap road follows the northern fork while Cottaquilla Road follows the southern fork (see Figure 1)

Bains Gap is the second major gap along Choccolocco Mountain. The headwaters of Cane Creek lie within the gap. Cane Creek parallels Tallaseehatchee Creek and flows westward to its confluence with the Coosa River. Bains Gap lies four miles south of Whites Gap. (see Figure 1).

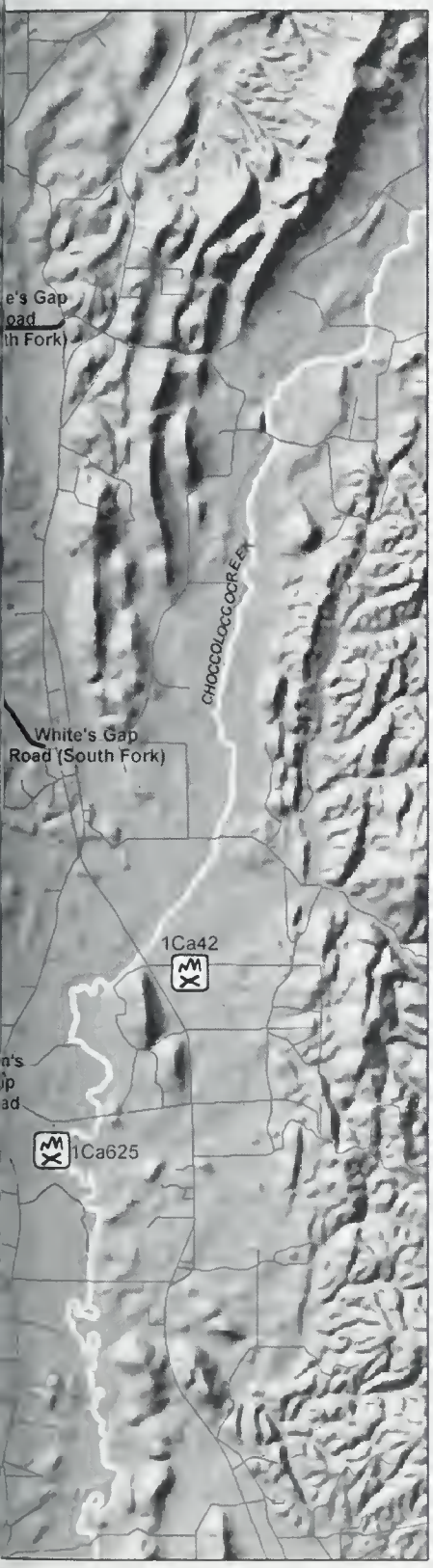
From the eastern edge of Choccolocco Valley and extending several miles eastward into the Piedmont Physiographic Province and the Tallapoosa River drainage are outcrops of lithic resources that were highly valued by aboriginal populations. Greenstone, mica, quartz crystals, vein quartz and quartzite outcrops occur along a north-south band beginning near the northern end of Choccolocoo Valley and running as far south as Montgomery County, Alabama (Jones 1939; Tull et al.. 1978)

The Tolbert Farm Complex lies in the western foothills of Choccolocco Mountain less than two miles from Whites Gap. Little Tallasscehatchee Creek flows basically north-south through Tolbert Farm. However, Little Tallasscehatchee Creek flows westward and joins Tallaseehatchee Creek continuing for twenty miles to its confluence with the Coosa River. The six sites are situated on a series of small rises, terraces and hills overlooking the Little

Figure 1. Topographical Relationships among Calhoun County Archaeological Sites.



un County Archaeological Sites



Recorded Sites

Tolbert Complex

Isolated find

Hydrography

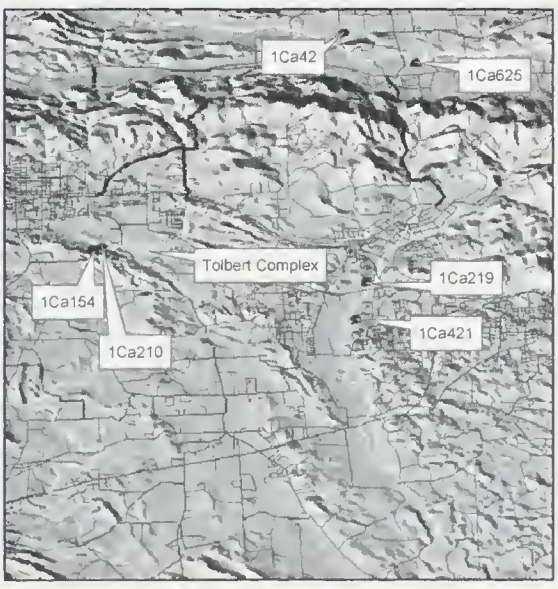
Significant roadways

Roads

Source
Hillshade created from USGS 7 5' DEMs
Projection.
Universal Transverse Mercator
North American Datum 1927
Map created by Michael Rice, JSU Archaeological Resource
Laboratory 2/13/2003

Miles
1 0.5 0 1 2

The map to the left is a 3D view of Calhoun County, displaying the spatial situation of local archaeological sites in relation to several gaps passing through Choccolocco Mountain. The illustration below is a perspective view of the area. The view is looking east from the western edge of Calhoun County.
Note: The perspective view is not to scale.



Tallaseehatchee Creek. The elevation of the complex ranges from approximately 600 to 700 feet above sea level. The soil primarily is heavily eroded reddish sandy clay.

SITE DESCRIPTIONS

The Tolbert Farm Complex consists of six archaeological sites situated on a series of gently rolling slopes and rises adjacent to both banks of Little Tallasseehatchee Creek. These archaeological sites—1Ca201, 1Ca202, 1Ca203, 1Ca204, 1Ca205 and 1Ca295—have produced numerous Paleoindian/Early Archaic bifaces. Phillip Koerper of the Jacksonville State University History Department surface collected these sites in the 1970s and early 1980s. His extensive biface collection is included in the final point counts of Table 1 (see cover photo inset). The Jacksonville State University Archaeological Resource Laboratory staff revisited all of these sites in 1980 and 1981, conducted intensive surface collections and recorded each site in the Alabama Site Files at Moundville, Alabama. Whenever applicable, projectile points were classified on the basis of the Cameron and Hulse (1975) projectile point typology.

1Ca201

1Ca201 is the most northerly lying site situated on a slight terrace along the right bank of the Little Tallasseehatchee Creek. The site lies adjacent to a small spring at the base of a slope. Archaeological material was widely scattered over the terrace. Jacksonville State University survey crews recovered pitted and battered cobbles, greenstone flakes and quartz and chert debitage and biface fragments. One Wheeler (Paleoindian), two Lecroy (Early Archaic) and two Pine Tree (Early Archaic) bifaces were found (see Table 1)

1Ca202

1Ca202 lies in the northern portion of the Tolbert Farm Complex on a rise adjacent to the creek and across the stream from 1Ca201. Archaeological material was widely scattered over the field, but there was a concentration of material in the southwest corner of the field adjacent to the creek and the Jacksonville-Alexandria Highway. 1Ca202 is a multicomponent ceramic site, yielding Archaic, Woodland and Mississippian artifacts. Jacksonville State University survey crews recovered nutstones, manos, two faceted quartz crystals, pitted/battered cobbles, quartz and chert debitage, greenstone ax fragments and numerous bifaces. One Kirk Corner Notched (Early Archaic) and three Morrow Mountain (Middle Archaic) bifaces were recovered (see Table 1)

1Ca203

1Ca203 is located due south of 1Ca202 on the south side of a dry ravine separating the two collecting areas. This multicomponent site yielded 44 complete and 22 fragmented bifaces. Twenty-six Morrow Mountain (Middle Arehaic), two Kirk Corner Notched (Early Archaic) and two Madison (Late Woodland/Mississippian) bifaces were recovered by Jacksonville State University crews. Quartz and chert debitage, battered/pitted cobbles, scrapers and a greenstone ax fragment also were recovered (see Table 1).

1Ca204

1Ca204 is both the highest and most southerly of the sites of the Tolbert Complex. 1Ca204 occupies a relatively flat ridge top, nearly 100 feet above Little Tallasseehatchee Creek. This site is the largest site (approximately one acre) of the complex.

Biface Type	Period	1Ca201	1Ca202	1Ca203	1Ca204	1Ca205	1Ca295
Clovis	P				4		
Angostura	P/EA				1		
Dalton	P/EA				6		
Wheeler	P/EA	2				1	1
Quad	P/EA				2		
Big Sandy	EA			1	12		
Decatur	EA						1
Early Archaic-like	EA	1					
Kirk Corner-Notched	EA		1	4	4	2	1
LeCroy	EA	2			16	4	3
Morrow Mountain	MA		3	26			
Palmer	EA				36		
Pine Tree	EA	3					
Benton Stemmed	MA		1				
Middle Archaic-like	MA				6		
McIntire	LA			1			
Afton	LA			2			
Kays	LA		2	1			
Elora	LA/EW			3			
Savannah River	LA			1			
Swann Lake	LA/EW			1	2		
Gary	LA/EW			8			
Ebenezer	W			3			
Halifax	W			1			
Montgomery	W			1			
Jack's Reef	LW				1		
Flint River Spike	LW		1	1	1		
Elora	LA/EW			3			
Hamilton	LW			1	1	1	
Madison	LW/M		2	3		3	2

Table 1. Tolbert Farm biface types (Typology based on Cambron and Hulse, 1975)

Symbol	Period
P	Paleoindian
EA	Early Archaic
MA	Middle Archaic
LA	Late Archaic
EW	Early Woodland
W	Woodland
LW	Late Woodland
EM	Early Mississippian
M	Mississippian

Numerous bifaces were collected from this locale. Included in this collection were two Clovis (Paleoindian), one Quad (Transitional Paleoindian), six Big Sandy (Early Archaic), nine Leeroy (Early Archaic), 15 Palmer (Early Archaic) and two Kirk Corner Notched (Early Archaic) bifaces. A Paleoindian/Early Archaic presence is well documented from this locale. This site has also yielded Middle and Late Archaic, Early Woodland, Late Woodland and Mississippian bifaces. Greenstone ax and adz fragments, mica fragments, chert, quartz and quartzite debitage and plain grit- and sand-tempered ceramics have been recovered from 1Ca204. Directly east of this high rise across the creek in the floodplain lies 1Ca295, another Paleoindian/Early Archaic site (see Figure 1).

1Ca295

1Ca295 is situated on a small rise adjacent to Little Tallassechatchee Creek. In a relatively restricted 70 meter by 70 meter area, several Paleoindian/Early Archaic bifaces have been recovered. A Decatur, a Wheeler, several Kirk Corner Notched and a double-fluted Paleoindian biface base fragment were recovered by Jacksonville State University survey crews as well as scraper fragments, quartz and chert debitage, pitted cobbles and greenstone flakes. Two Late Woodland/Mississippian bifaces also were recovered (see Table 1).

1Ca205

1Ca205 is situated on a large flat-topped hill, which slopes down to the west where 1Ca203 lies near its base. 1Ca205 yielded four Leeroy (Early Archaic) and two Kirk Corner Notched (Early Archaic) and Wheeler (Paleoindian) bifaces. One Hamilton (Late Woodland) and three Madison (Late Woodland/Mississippian) bifaces were recovered. Quartz and chert debitage, greenstone debitage and utilized flakes also were recovered (see Table 1).

It should be mentioned that there are four other sites on the right bank within the Tolbert Farm Complex that have yielded a number of Middle/Late Archaic, Woodland and Mississippian bifaces. Since no Paleoindian or Early Archaic bifaces have yet to be recovered from these locales, these sites were not discussed in the paper. Likewise, within a quarter of a mile downstream of Tolbert Farm lies a small multicompont Early Archaic through Woodland site, 1Ca210, with an associated stone mound, 1Ca157. Also within a mile upstream of Tolbert Farm five more Archaic, Woodland and Mississippian sites have been recorded. These data indicate a dense occupation and/or presence of aboriginal groups along this segment of Little Tallassechatchee Creek from the Paleoindian through Mississippian periods. The proximity of this portion of the creek to Whites Gap may explain this heavy prehistoric aboriginal occupation.

WHITES GAP, BAINS GAP AND CHOCCOLOCCO VALLEY

It appears, based on the archaeological data acquired from Tolbert Farm, that the Whites Gap access route through Choccoloco Mountain was a funnel for aboriginal populations into Choccolocco Valley since Late Pleistocene times. For nearly three decades, the Archaeological Resource Laboratory at Jacksonville State University has conducted research within the Choccoloco Valley. This research includes intensive surveys of portions of the valley, excavations of several sites and geological surveys of lithic resources. From this research it appears that the Choccoloco Valley played an important role for regional aboriginal groups.

Choccoloco Valley archaeological surveys and excavation have produced numerous Paleoindian/Early Archaic bifaces. Contemporary Paleoindian and Early Archaic sites have

been located on the eastern side Whites Gap in Choccolocco Valley along Choccolocco Creek. The Morgan Mountain Village Site, 1Ca42, was excavated in 1984 through 1986 by Jacksonville State University staff and students (Little, Brown and Holstein 2000). Morgan The Mountain Site lies a few miles south of the south fork of Whites Gap (see Figure 1). This multicomponent site contains Paleoindian through Mississippian components. Paleoindian Wheeler (Paleoindian), Morrow Mountain (Middle Archaic), Kirk Corner Notched (Early Archaic), and Dalton (Late Paleoindian) bifaces have been recovered from this site.

In 1999 through 2001, Archaeological Resource Laboratory staff and students excavated the prehistoric multicomponent Bains Gap Site, 1Ca625. This large prehistoric village lies along the right bank of Choccolocco Creek less than a mile east of Bains Gap. Although the Woodland component is the most dominant, numerous Transitional Paleoindian, Early Archaic and Middle Archaic bifaces have be recovered from the site (Holstein n.d.).

Along the western flank of Choccolocco Mountain along a tributary stream of Cane Creek, Panamerican Consultants and Jacksonville State Archaeological Laboratory staff investigated 1Ca567 (Panamerican Consultants 2000 and Little et al. n.d.). 1Ca567 lies approximately two miles south of Bains Gap. This small lithic procurement site yielded artifacts dating from the Early Archaic through Mississippian periods and also contained a nineteenth-century industrial site.

Further downstream along the right bank of Cane Creek at site 1Ca219, Jacksonville State survey crews recovered a temporally diagnostic Early Archaic Edgefield Scraper. 1Ca219 also yielded one Kirk Corner Notched (Early Archaic) base fragment (Holstein, 1983). Two miles further downstream near Finks Lake, JSU survey crews recovered a double fluted Paleoindian base fragment as an isolated find.

Approximately three miles west of Bains Gap along the left bank of Cane Creek lies the Blue Hole Village Site, 1Ca421. From 1989 through 1991, Jacksonville State University staff and students excavated this large prehistoric village and associated stone and earthen mound. Numerous Dalton (Transitional Paleoindian), Lecroy (Early Archaic), Morrow Mountain (Middle Archaic), Kirk Corner Notched (Early Archaic) and Kirk Serrated (Middle Archaic) bifaces were recovered during the excavations (Holstein n.d.).

Hence similar to the Tolbert Farm Complex lying five miles to the north, contemporary Paleoindian and Early Archaic sites lie in the vicinity of Bains Gap on both sides of Choccolocco Mountain. These gaps have attracted prehistoric populations since the Pleistocene and have provided a direct path entering and exiting Choccolocco Valley.

CONCLUSIONS

Over the last two decades, Jacksonville State University staff and students, other professional archaeologists and dedicated amateur archaeologists have contributed a vast amount of information concerning aboriginal populations in northeast Alabama. Survey and excavation data indicated Choccolocco Valley played a major role in funneling aboriginal populations along a north-south corridor. Choccolocco Creek's headwaters are less than a quarter mile from Nances Creek headwaters in the northern end of Choccolocco Valley. Choccolocco Creek and Nances Creek are separated by a relatively low divide. Nances Creek flows northeast for approximately ten miles to its confluence with Terrapin Creek. From this confluence, Terrapin Creek flows north to Centre, Alabama, where it joins with the Coosa River. Aboriginal groups traveling out of the Tennessee Valley or northwest Georgia could

have entered the Coosa River valley northeast of Centre, traveled up Terrapin Creek, then up Nances Creek over the slight divide into the Choccolocco drainage, ultimately returning to the Coosa River just northwest of Talladega, Alabama. This route effectively cuts off twenty or more miles for groups of people traveling up or down the Coosa River.

Choccolocco Valley would have drawn aboriginal populations as an access to the greenstone, mica, quartz and other metamorphic rock resources in the Piedmont. The Choccolocco Valley represents an ecotone between the Ridge and Valley Province and the Piedmont Physiographic Province. On the west side of the valley, Choccolocco Mountain represents the first major ridge of the Ridge and Valley Province. Along the eastern side of the valley the rolling, rugged hills of Piedmont Physiographic Province begin. A type of greenstone is readily available throughout the eastern edge of the Choccolocco Valley eastward into the Tallapoosa River drainage (Holstein et al. 1989:54). Greenstone artifacts, debitage and unmodified chunks are frequently found on 40 percent of all sites recorded in the region (Holstein and Little 1984). Greenstone and mica artifacts quarried from eastern Alabama are found throughout the eastern United States. Recently, eight greenstone celts recovered from three Late Mississippian sites in northeast Arkansas were determined to have been made from Alabama Hillabee greenstone (Gall et al. 2002). The fact that this material of limited availability outcrops readily along the entire length of Choccolocco Creek Valley, and the fact that the valley itself is a natural north-south shortcut through the Coosa Valley, would have attracted aboriginal populations throughout prehistory. Whites Gap and the Tolbert Farm Complex would be directly in the path of the various groups entering or exiting the Choccolocco Valley. This may also explain the relative quantity of Paleoindian and Early Archaic bifaces recovered from the Tolbert Farm Complex. Aboriginals heading east from the Tallaseehatchee Creek drainage would have in all likelihood passed by Tolbert Farm sites as they entered or exited Whites Gap.

All Tolbert Farm complex sites and the majority of all sites that were discussed located along the western slope of Bains Gap and Whites Gap yielded archaeological materials obtain from the Piedmont Physiographic Province. Tolbert Farm Complex sites yielded quartz crystals, mica, quartz and greenstone. This evidence indicates that the site occupants exploited rock and mineral outcrops in the Piedmont.

Hence, Coosa Valley populations desiring access to lithic resources of the Piedmont from Paleoindian/Early Archaic times needed an east-west pathway across a formidable north-south barrier, Choccolocco Mountain. The principle of least effort hypothesis suggests that sites are located in order to minimize time spent in acquiring resources to maximize the returns on those resources (Zipf 1949). Utilizing the Geographic Information System's shortest path analysis program based on slope and on elevation; Whites Gap and Bains Gap provided the shortest distance between all archaeological sites discussed in this paper. Whites Gap and Bains Gap would provide the most direct and easy east-west access into the central Choccolocco Valley from the Coosa drainage and apparently human populations realized this from their very first arrival into the area.

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LITERATURE CITED

Cambron, James W. and David C. Hulse, 1975 *Handbook of Alabama Archaeology, Part 1:Point Types.* Alabama Archaeology Society.

DeJarnette, David L., Edward B. Kurjack and Bennie C. Keel, 1973 *Archaeological Investigations of the Weiss Reservoir of the Coosa River in Alabama.* Journal of Alabama Archaeology 19 (1-2).

Driskell, Boyce N., 1994 *Stratigraphy and Chronology at Dust Cave. Journal of Alabama Archaeology 40(1&2).*

Gall, Daniel G., Robert C. Mainfort, Jr., and Rita Fisher-Carroll, 2002 The Occurrence of Greentstone at Late Period Sites in Northeast Arkansas. *Southeastern Archa*eology 21(2).

Griffin, John W., 1974 *Investigation in Russell Cave. Publications in Archaeology 13.* National Park Service. I/S. Department of Interior. Washington, D.C.

Harlin, William V. and E.A. Perry, 1961 Soil Survey of Calhoun County, Alabama. United States Department of Agriculture. United States Printing Office.

Holstein, Harry O., 1983 *A Diagnostic Late Paleoindian/Early Archaic Artifact from the Upper Coosa Drainage, The Edgefield Scraper.* Journal of Alabama Archaeology 29 (2). *Nd The Bains Gap Site, 1Ca625 A Multicomponent Prehistoric Village Site Along Choccolocco Creek in Northeastern Alabama. Report in Progress.*

Holstein, Harry O., Danny S. Vaughan and Robert P. Blair, 1989 *The Morgan Mountain Stone Mound Complex, Site 1Ca32, Calhoun County, Alabama.* Journal of Alabama Archaeology 35 (1).

Holstein, Harry O. and Keith J. Little, 1982 The Validity Test of the 1980 McEachern Archaeological Predictive Model of Fort
McClellan, Alabama. Report submitted to the U.S. Corps of Engineers, Mobile District.

Holstein, Harry O. and Keith J. Little, 1986 A Short-Term Archaeological Investigation of the Davis Farm Archaeological Complex, A Multicomponent Prehsitoric Site in Calhoun County, Alabama. Archaeological Resource Laboratory Series Number 1, Jacksonville State University.

Jones, Walter B., 1939 *Geology of the Tennesse Valley Region of Alabama, with noteson the Topographic Features of the Area and the Effects of Geology and Topography upon Aborignal Occupation. In An Archaeological Survey of the Wheeler Basin on the Tennessee River in Northern Alabama, by* William S. Webb. Smithsonian Institution Bureau of American Indian Ethnology Bulletin 122.

Little, Keith, Laura E. Brown, and Harry O. Holstein,2000 *A Preliminary Report of Field-School Excavation at the Morgan Mountain Village Site. Submitted to the Alabama Historical Commission, Montgomery, Alabama.*

Neilson, Michael J., 1980 Appendix 1:Site Description. *In Statistical Evaluation and Predictive Study of the Cultural Resources at Fort McClellan, Alabama,* by Michael McEachern, Nancy Boise, David G. Hunt and C. Roger Nance. University of Alabama, Birmingham.

Panamerican Consultants, 2000 *Archaeological Phase II Testing At Twelve Sites on the Fort McClellan Military Reservation Calhoun County, Alabama. Prepared for The U. S. Army Chemical and Military Police Centers and Fort McClellan, Alabama*

Tull, James F., Stephen H. Stowe, Lamar Long, and Bertram Hayes-Davis, 1978 *The Hillabee Greenstone: Stratigraphy, Geochemistry, Structure, Mineralization and Theories of Origin. MRI Research Report Series 1. The University of Alabama Mineral Resources Institue and Stae Mine Experiment Station.*

Zipt, George K., 1949 *Human Behavior and the Principle of Least Effort. Addison-Wesley. Cambridge.*

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CIRCADIAN RHYTHM OF *ASPERGILLUS NIGER* AND *PENICILLUM NOTATUM*: A COMPARATIVE ANALYSIS

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ABSTRACT

The objective of this research was to conduct a comparative analysis of two Hyphomyeete fungi, *Penicillium notatum* and *Aspergillus niger*, to demonstrate differences in their sporulation and endogenous timing periods that are commonly referred to as eireadian elocks or rhythms. Spores of *Penicillium notatum* (29-7968 B251) and *Aspergillus niger* (29 – 7872) purchased from *Carolina Biological Supply* were cultured in nutrient agar under three different environments: (a) continuous darkness (b) continuous light and (e) alternate 12 hour periods of light and dark, at room temperature. The diameter of each colony growth was measured every 24 hours for five days. Visual observations were augmented by use of a spectrophotometer. *A. niger* showed remarkable differences in the rate of growth, best exhibiting the internal elock. Overall, there was significantly more growth in continuous light followed by alternation of light and continuous darkness. In the continuous light environment, growth of the colonies was 56% more than in the continuous dark environment and 25% more than in the alternating light/dark environment. Colony growth of *P. notatum* did not show notable differences in the diameter of growth in any of the three environments. The presence of light seemed to increase the rate of sporulation in *Aspergillus* but not in the *Penicillium* species.

INTRODUCTION

Biological elocks have been identified in many organisms, including human, birds, fish, and reptile; insects, crustaceans, and mollusks; flowering plants, weeds, and trees; and even in single-celled forms, such as algae and fungi (Charles Weitz 1995). The protein components of biological elocks ean be used to elucidate genes impacting on the human biological elock. *Aspergillus niger* and *Penicillium notatum* are both fungi of commereial and medical importance. They are related phylogenetieally and morphologieally and knowledge of their internal eloeks could provide insight into their chemical reactions at the molecular levels. Cireadian rhythms in *A. niger* and *P. notatum* and other eukaryotie organisms must have an input which could be the light signal, a master eloek

or a central circadian pacemaker that directs and integrates the light signal and dictates the day-night cycle of activities, and the output which is the circadian gene expression (Wolf et al, 2001).

Charles J. Weitz 1995 stated, "the Earth's daily light-dark cycle is not required for circadian rhythms, but it strongly influences the circadian system. It causes the circadian system to be reset each day so that an organism's intrinsic period becomes precisely synchronized, or "entrained", to the 24-hour day. This entraining puts the internal cycle in a fixed and proper relationship to the external light and dark cycle, allowing the circadian system to serve as a true "biological clock". The objective of this research was to compare the circadian rhythms of two hyphomycete fungi, *A. niger* and *P. notatum* and also to elucidate the effects of light on their vegetative growth and sporulation.

MATERIALS AND METHODS

Aspergillus niger 29-7872 and *Penicillium notatum* 29-7968 were obtained from a commercial vendor (Carolina Biological Supply) and colonies were grown in potato dextrose agar. Sterilized Potato Dextrose agar was poured into nine Petri dishes and allowed to solidify at room temperature. Petri dishes were each inoculated with a loopful of *A. niger* spores. After a 24-hour incubation period at 23º C, three Petri dishes were subjected to a continuous light environment, three Petri dishes were subjected to continuous darkness, and the final three were subjected to 12 hours of light and 12 hours of darkness alternately. Petri dishes were kept at room temperature for five days. The above procedure was repeated using *P. notatum* spores. The diameter of colony growth was measured in millimeters after 24 hours for 5 days (where there was no further growth in dark environments), and the average of the growth in the three Petri dishes was recorded for each environment. Fungal growth was recorded and plotted as a function of time. To augment visible results, the spectrophotometer was used and the absorbance of light in the spectrophotometer was directly proportional to the fungal mass. Rehydrated culture vials of the *Penicillium* and the *Aspergillus* species were reconstituted in nutrient broth and were incubated for 24 hours in the above-mentioned environments. Each culture was serially diluted (1:1, 1:2, 1:4, 1:8, and 1:16). The percent transmittance of each dilution registered on the galvanometer was mathematically converted to optical density values and the results were plotted graphically using Seeley procedure (Seeley et al. 1991). As a safety precaution, the procedures were done under a lamina flow hood.

RESULTS

Aspergillus niger in a continuous light environment showed the most rapid growth rate, averaging 80mm by day 5, followed by an alternating 12 hour 4D (60mm growth). Continuous dark environment supported the least growth with an average of 35mm diameter growth. Unlike *A. niger, P. notation* had an average growth of 25 mm in all three environments (Table 1).

Colonies of *A. niger* specie in the continuous dark environment had long filamentous hyphae, fewer conidia, and light gray mycelia; whereas, in the continuous light, mycelia appeared dense and the conidia appeared dark. *P. notatum* mycelia and conidia did not spread out as much in agar as was the case in *A. niger*. However, *P. notatum* subjected to the aforementioned environmental conditions, showed no differences in both the vegetative growth and sporulation (Table 2).

DISCUSSION

Aspergillus niger and *Penicillium notatum* are naturally occurring moulds that are known for their biochemical attributes (Donald T. Wicklow 1985). "Individual taxa are recognized as components of soil mycoflora, as colonists of agricultural produce and products, as pathogens of insects and vertebrates, as domesticated forms used in food fermentations, and as commercial sources of enzymes, organic acids, antibiotics, and assorted other natural produce" (Wicklow 1985). Knowledge of the environmental conditions required for fungal growth and optimum production of primary and secondary metabolites is commercially and medically important. This limited study of *A. niger* indicated that exposure to continuous light increased fungal growth and possibly more production of biochemical products.

Table 1. Growth of *Aspergillus niger* in three different environments.
Diameter in mm

Day	Continuous Light	Continuous Dark	12 Hours Light 12 Hours Dark
1	7mm	7mm	6mm
2	27mm	12mm	21mm
3	48mm	22mm	43mm
4	60mm	35mm	50mm
5	80mm	35mm	60mm

According to Sewell 1959, *Penicillium* tends to densely colonize small individual substrates with no extension of the mycelia into the surrounding soil and then produces conidia heavily over the surface. This observation was confirmed by the visual results of this research in regard to *A. notatum* and could explain the absence of a biological clock.

Table 2. Growth of *Penicillium notatum* in three different environments
Diameter of growth in mm

Day	Continuous Light	Continuous Dark	12 Hours Light 12 Hours Dark
1	5mm	7mm	6mm
2	8mm	8mm	9mm
3	10mm	12mm	14mm
4	16mm	17mm	16mm
5	25mm	22mm	25mm

Understanding of circadian rhythms in fungi is crucial to biologists, food mycologists, taxonomists, agriculturists and pharmacists. Research findings may someday lead to production of biochemical products that could help treat disorders associated with the human biological clock.

REFERENCES

Charles J. Weitz, M.D. 1995. PhD CLOCKWORK GENES. *The Harvard Mahoney Neuroscience Institute Letter*, ON THE BRAIN. Fall 1995 Volume 4, Number 4 http:/www.med.Harvard.edu/publications/On-The.../F95Clock.htm 11/25/01.

Davis, A 1998. It's About Time: Biological Clock Research Keeps Ticking 1998, (301) 469-7301.

Hastings, M. 1994. What makes the clock tick? *Current Biology*, 4(8): 721-233.

Roennebert, T., Merrow, M. 2001. P4/14.13-Molecular mechanisms in *Neurospora*: light and circadian clocks. SOCIETY FOR EXPERIMENTAL BIOLOGY ABSTRACTS PLANT AND CELL TOPICS http:/www.plantstress.com/admin/Files/SEB-Abstracts-4-2001.pdf

Seeley, H.W. Vandemark, P. and John. J.Lee 1991. Microbes in Action 4th Edition pp. 109-111. W.H. Freeman and Company New York.

Sewell, G.W.F. 1959. Studies of fungi in a Calluna-heathland soil II. By the complementary use of several isolation methods. Trans. Br. Mycol. Soc. 42: 354-36.

Wicklow, D.T. 1985. Ecological Adaptation and Classification on *Aspergillus* and *Penicillium*. Advances in *Penicillium* and *Aspergillus* Systematics 255-262.

Worf, E. C. Theiss, O. Yildiz, A Berndt. And S. Lohrengel, 2001. Structural Characterization of Biological Clock Protein.

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ALABAMA ARTIFICIAL REEF PROGRAM

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The natural bottom offshore Alabama is predominately flat sand, gravel and mud. This bottom type attracts very few fish that are either commercially or recreationally valuable. However, it has long been known that if vertical relief is created on this bottom, many reef fish such as snappers and groupers will be attracted (Shipp personal comm.). Shortly after the Second World War, local charter boat captains and commercial fishermen discovered that they could catch valuable reef fish at locations where artificial structures (ships, planes, etc.) had accidentally found their way into the Gulf of Mexico. It did not take them long to equate bottom structure with reef fish and make the transition from finding material to placing material on the bottom. In the early 1950s the Alabama Department of Conservation and Natural Resources was approached and asked if they would deploy car bodies to act as artificial reefs. The department agreed, and thus the Alabama artificial reef program began. This proved to be very successful and in the years since, many different types of materials have been placed offshore of Alabama. These have included additional car bodies, culverts, bridge rubble, barges, boats and planes. In 1974 – 75, in an excellent example of State/Federal cooperation, several "ghost-fleeted" liberty ships were sunk in five locations off Mobile and Baldwin Counties in 80 - 93 feet of water.

In 1987 a general permit was issued by the U. S. Army Corps of Engineers creating specific areas offshore of Alabama for the creation of artificial reefs. These were created to provide areas for these materials in order to coordinate with other users of the offshore area. In 1987 the areas encompassed almost 800 square miles.

REEF - EX is the program name associated with the concept of deploying obsolete military combat tanks in the Gulf of Mexico and the Atlantic Ocean as artificial reefs. In 1993 the U.S. military, in addressing the need to de-militarize obsolete battle tanks, realized that immersion in seawater was an acceptable method to render the tank inoperable. The idea of using these obsolete military materials to create artificial reefs was born. The idea was presented to the Alabama Department of Conservation and Natural Resources, Marine Resources Division, and development of an operation plan began. As plans developed, the full extent of the impact that this program would have on the reef fisheries and associated

Between June 1994 and September 1994, 100 military combat tanks were deployed in the general permit area off of Alabama. The tanks had been inspected to ensure that no environmental threat was posed to the Gulf of Mexieo. All hazardous materials were removed, including all oils, hydraulie fluids and other fuel. All military hardware such as munitions and radioactive materials were also taken from the tanks. All other EPA requirements were met, as well as other various agency requirements described. These 100 tanks sit in depths of 70 to 110 feet of water within the Hugh Swingle and Don Kelley North artificial reef areas. This makes them easily accessible to scuba divers as well as fishermen.

The conservative estimate for the life span of the tanks is 50 years as artificial reefs. The potential economic impact of these tanks as artificial reefs during this time is millions of dollars. Even this eonservative estimate far outweighs any other method of removing these tanks from military service. It is an outstanding and creative way to convert swords into plowshares.

In late 1997 the U. S. Army Corps of Engineers authorized an expansion of Alabama's artificial reef construction areas to allow for greater freedom in reef placement and greater variety in depth. The combined area for all reef permit zones now encompasses approximately 1260 square miles. At the same time, the protocol for reef construetion was modified. This modification limited the types of materials that can be used to construct artificial reefs. Enforcement of the protocol and plaeement of reefs is a joint effort of the Marine Resources enforcement section, the Alabama Marine Police Division, and the U. S. Coast Guard.

Because of the artifieial reefs offshore of Alabama, fishermen now eateh 35-40% of the recreationally eaught red snapper in the Gulf of Mexico (Schirripa, 1998). Considering Alabama's shoreline constitutes approximately 5% of the northern Gulf of Mexico, that is an ineredible statistic. Data colleeted from the video/trap set portion of the Southeast Area Monitoring and Assessment Projeet (SEAMAP) show that during the period of 1993-96, Alabama conducted an average of 5% of the sets, but in contrast captured 91% of the red snapper Gulfwide. Other reef fishes including grouper, amberjaek, triggerfish, vermillion snapper, and lane snapper are now caught because of the reefs. As the program has developed, the fishing industry has expanded. Currently there are 143 charter boats in Alabama that fish in the Gulf waters. The vast majority, 90% plus, bottom fish for red snapper as their primary target species. It has been estimated that the charter industry generates approximately 60 million dollars in revenue annually (Malone, 1994). The private recreational sector has not been directly estimated, but it would appear to be just as luerative, if not more so, than the charter industry. A survey conducted in 1996 (Thomas, 1996) to define the saltwater freshwater split in the allocation of federal sport-fish monies included questions on the target speeies. It was expected that an inshore speeies such as spotted sea trout or red drum would rank first, but red snapper was the number 1-targeted fish for Alabama saltwater fishermen. The survey also pointed out that this was not just a coastal phenomenon. The survey reported that of the people that fished in upstate Birmingham, 33% fished in saltwater.

Artificial Reef

In 1996 we realized there was a need for artificial reefs within Alabama's inshore waters to provide fishing opportunities for fishermen who preferred to fish these areas. Therefore, when bridge rubble from the replacement of several coastal river bridges became available as reef material, the division personnel began to examine possible sites.

The first two sites developed into inshore artificial fishing reefs were at the derelict Fish River oyster reef and the old Shellbank oyster reef. Concrete bridge pilings and rubble were deployed in a roughly circular ring on the hard substrate of the historic reefs. The reefs were completed by placing cultch material inside the rings to promote the creation of a natural oyster reef community.

In 1998 a similar reef was constructed on the western side of Mobile Bay on the remnants of Whitehouse oyster reef. Oyster cultch material was placed within the interior of this reef in August of 1998, completing the largest inshore artificial reef to date in Alabama's inshore waters with an area of approximately 75 acres and a mile in circumference.

Plans are to continue to expand this program of inshore artificial fishing reefs. The Division was recently offered concrete culvert as artificial reef material. Working with local conservation groups, commercial shrimp fishermen, and Mobile County, the division plans to create additional inshore reefs in the next couple of years.

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BOOK REVIEW

BIOETHICS FOR THE TWENTY FIRST CENTURY AND BEYOND: WHERE OUGHT WE LOOK FOR GUIDANCE?

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Our Posthuman Future - Consequences of the Biotechnology Revolution, Francis Fukuyama. 241 pp. plus bibliography, New York, NY: Farrar, Straus and Giroux, 2002.

During the summer of 2001 public debate about ethical issues surrounding embryonic stem cell research and other 21st century biotechnologies was well underway. But since early autumn of that year, American interest in this debate waned in deference to warring against homeland terror. To view this as the rightful trumping of an urgent security issue over less urgent ethical issues may be a mistake. For according to Francis Fukuyama in *Our Posthuman Future - Consequences of the Biotechnology Revolution*, nothing less than the fate of liberal democracy and the future of human nature are at stake in the biocthical debates.

Widely published as an international political economist and social historian, Fukuyama is Dean of Faculty at the Paul H. Nitze School of Advanced International Studies, Johns Hopkins University, and serves on the President's Council on Bioethics.

In his 1992 book, *The End of History and the Last Man* (Free Press), Fukuyama claimed that history had ended because major alternatives to liberal democracy such as Nazism and Communism had failed. Now acknowledging the formative roles science and technology play in shaping the social order, his revised position is that social history continues because science is not ended. He believes that discoveries and technologies in the life sciences are poised to permanently change the shape of global society, as well as the essence of our species. Professor Fukuyama is exercised over this, and he would like for us to feel likewise. Why we should worry about applications of biotechnology and how we can avert social and biological catastrophe without becoming biotech Luddites are the subjects of *Our Posthuman Future*, his fourth and most recent sole-authored book.

The book has three parts: the first is about specific outcomes of biotechnology, both near-term and distant; the second argues that preserving human nature is the proper goal for moral and political responses to 21st century biotechnology; and, the third addresses the regulation of biotechnology. Six chapters comprise Part I, and Parts II and III each contain three chapters. The book's aim is to argue "that the most significant threat posed by contemporary biotechnology is the possibility that it will alter human nature at its biological foundations and thereby move us into a 'posthuman' stage of history."

The biotechnological revolution is sometimes mistakenly equated with genetic engineering. In fact, advances in other areas of biology including cognitive neuroscience,

population genetics, behavior genetics, psychology, anthropology, evolutionary biology and neuropharmacology may usher in a posthuman stage of history within a decade or a generation from now. In Part I of the book, Fukuyama identifies four biotechnology driven "pathways to the future" of humankind: (1) increased knowledge about brain function and about the biological bases of human behavior, (2) expanded ability to manipulate human emotions and behavior neuropharmacologically, (3) prolongation of life, and (4) engineering of the human genome.

Fukuyama warns that the imminent expansion of our understanding of the genetic components of intelligence, sexuality, criminal behavior, and male-female differences will be paralleled by an expanded ability to control human behavior and emotions chemically. In 1999 Princeton biologist Joe Tsien was able to manipulate memory capacity in mice up or down by adding or subtracting single genes to the mouse genome. Identification of genes responsible for other specific brain functions and existing genetic screening technologies will ultimately make it possible to identify individuals with character traits chemically targetable for therapy or enhancement. When the neuropharmacological control of the expression of specific traits becomes possible, questions far more difficult than those posed by the use of substances like Prozac and Ritalin will arise. What criteria should be used to identify personality "disabilities", and what levels of disability warrant chemical therapy? Ought non-addictive drugs be available for personality enhancement, and if so, how should their use be regulated? What could be the social consequences of "happiness drugs" like the soma of Aldous Huxley's *Brave New World* or of agents able to affect sexual preference, sociability, and gender-associated traits?

Dramatic extension of human life spans with accompanying demographical and socio-political changes is another likely near-term result of biotechnology. Development of stem cell therapy to replace damaged and worn out tissues and organs along with increased knowledge about the cellular basis for senescence and how to counteract it may produce median ages of 70 or higher in developed nations. The potential social impact of a median age of 70 is appreciated when one considers that the median age in the United States was 19 in 1850 and only 34 by the 1990s. Fukuyama predicts that "...the world may well be divided...between a North whose political tone is set by elderly women, and a South driven by..super-empowered angry young men." This prediction is based in part on the assumption that increased longevity in developed countries will favor women, though no basis for this assumption is provided.

As for other animals, genetic engineering in human beings can be directed at somatic cells or at the germ line. The former excludes genetic changes in eggs or sperm (although these might sometimes occur accidentally) and therefore does not normally affect succeeding generations. By contrast, germ cell engineering purposefully produces genetic changes that are passed on to future generations. Fukuyama warns that although human germ line genetic engineering may be 50-100 years off, it is by far the most consequential of the four biotechnology-driven pathways to humankind's future because of its potential for permanently altering human nature itself.

A gene-based change in human nature could be brought about inadvertently or purposefully. Germ-line alteration of the expression of a gene presumed to have only one function but which is in fact multifunctional could have unintended, devastating consequences. Purposeful resculpting of human nature not only presumes highly specific knowledge about the genetic basis for human-specific traits, but also an understanding of and general agreement over what traits constitute human nature. Fukuyama is right to worry about the day when humankind

undertakes to re-engineer its very essenee. I believe he is also right in saying that the means for doing this in any controlled fashion are not imminent. I suspect they are more than a century away. Part II of the book convinees me that we may need that amount of time to reach agreement on what constitutes human nature.

Fukuyama maintains that fundamental human rights must rest upon an understanding of and be derived from human nature. To arrive at this position, he discards notions of deriving human rights from religion or by the political proeess because consensus is not possible via these routes. In arguing for a human nature-based origin of "natural rights", Fukuyama must discuss the "is-ought" problem in philosophy. That is, if human nature consists of a partieular assemblage of traits, does it follow that this assemblage *ought* to be protected and preserved? Countering philosophers like Kant and Hume and present seholars like Paul Ehrlich who criticize those who use human nature as a guide to morality for having fallen prey to a "naturalistie fallaey", Fukuyama devotes 15 pages to explaining why he believes the naturalistic fallaey is fallacious. He argues for a return to a pre-Kantian concept of natural rights based upon human nature. Moral philosophers are better qualified than I to evaluate Fukuyama's argument. What is clear even to a biologist though is that the subjectivity involved in settling on the "is" of the is-ought pairing (i.e. what *is* human nature) is a major difficulty to be solved.

Fukuyama devotes most of two ehapters to this problem, providing us with the following definition of human nature: "...the sum of the behavior and charaeteristics that are typical of the human species, arising from genetie rather than environmental factors." *Typicality*, he explains, is a statistieal artifact referring "to something elose to the median of a distribution of behavior or charaeteristies."

I began reading this section with exeitement and anticipation. Fukuyama is not a biologist, but the biological concepts in the previous chapters had been presented extremely well. Since politieal and moral philosophy are within the realm of the author's professional training and experience, I looked forward to a synthesis of biological and philosophical elements of human nature robustly able to help us navigate the treacherous terrain of bioteehnology. That may have been expecting too much.

The very good point is made that almost any statement about human nature must either be probabilistic (not applying to all people at all times) or conditional (applying to most people under certain environmental conditions). Given these caveats to any attempt at lassoing in one or more defining traits for our species, and aeknowledging that environmental forces can mold human behavior into diverse shapes, Fukuyama accepts the notion that a significant component of human nature is still genetically based. I agree. And so does Edward O. Wilson who has referred to this component as a "genetic leash" (*Consilience*, New York, Alfred A. Knopf, 1998).

So our slate is not blank at birth, but neither is it filled. The ehallenge is to identify a Factor X that is written for us at the beginning of life and that gives us dignity and moral status higher than that of other organisms. Fukuyama eonsiders cognition, parental love, and reciprocity as candidates. Language acquisition is cited as an example of the first, the universal eontrol or condemnation of infanticide as an example of the seeond, and the faet that few eultures fail to make reciprocity a core component of moral behavior as evidence for the third.

But Fukuyama's further examination of these traits as eandidate specifiers of human nature results in disqualifieation of eaeh as being unique to *Homo sapiens*. Other charaeters often thought of as being diagnostically human - the apperception of faeial expressions and deceit, ability to feel embarrassment, attributing of causality to events - suffer the same fate. None are limited to human beings.

Fukuyama then considers whether free will, our capacity to make moral decisions, might qualify as Factor X. Within one-half page, this notion is rejected with the claim that "the vast majority of natural scientists" accept a materialistic account of the universe. In this view, according to Fukuyama, "all human decision making can ultimately be traced back to material causes" involving determinative cascades of events resulting in neuronal firings and resultant actions that we mistake as products of free will.

The author eventually concludes that Factor X is actually an assemblage of qualities including the capacity for moral choice, language, reason, sociability, sentience, emotions, and consciousness, that he and others have proposed as grounds for human dignity. None of these, it is claimed, can exist in the absence of the others.

Unfortunately, definitions for traits in the above assemblage are not offered. Moreover, observation and thought experiments lead me to reject the claim that none of these can exist without all of the others.

An error in this otherwise tightly constructed book is a too easy dismissal of free will as the essence of humanity. Nothing in my over 30 years in the community of natural scientists disputes Fukuyama's claim that a majority of us favors a materialistic explanation for the universe; however, an undocumented survey does not disprove the correctness or significance of the overwhelming experience of possessing a capacity for moral choice-making that I believe those same scientists (and the vast majority of humankind) would report. Even the unabashedly materialist father of sociobiology, E.O. Wilson, who acknowledges that free will is illusory in the sense that it is a product of physical phenomena, writes that "there can be no simple determinism of human thought...in obedience to causation in the way physical laws describe the motion of bodies and the atomic assembly of molecules...Thus,...in every operational sense that applies to the knowable self, the mind *does* have free will."

I maintain that the capacity for choice-making is Factor X, the core component of human nature that provides the opportunity for human dignity. It is the capacity for choice-making that must ultimately be honored and protected by legislation regulating biotechnology. In fact, Fukuyama's warning about a potential posthuman future for the species presumes that we can make choices that will affect our future, for better or for worse.

The species-specific nature of free will has not been more beautifully expressed than by the Italian Renaissance philosopher, Pico della Mirandola. In 1486 at age 23 he wrote in his *On the Dignity of Man* of the Creator speaking to Adam about what in its nature sets humankind unambiguously apart from all other creatures, both earthly and divine:

I have set thee in the midst of the world, that thou mayest the more easily behold and see all that is therein. I created thee a being neither heavenly nor earthly, neither mortal nor immortal only, that thou mayest be free to shape and to overcome thyself. Thou mayest sink into a beast, and be born anew to the divine likeness. The brutes bring from their mother's body what they will carry with them as long as they live; the higher spirits are from the beginning, or soon after, what they will be for ever. To thee alone is given a growth and a development depending on thine own free will. Thou bearest in thee the germs of a universal life.

Pico's words can inspire us for the road ahead as we seek to wisely regulate biotechnology. We must somehow protect the genetically endowed capacity of our species for

choosing while not overly restricting the freedom of individuals to shape and overcome themselves. The book's Part III does a superb job of telling where we are now on that road and about the difficulties that must be overcome on the way to obtaining international policies that secure both freedom and protection for individuals and also for the species.

Our Posthuman Future is an important book. It raises problems that demand political solutions, and the problems are framed with attention to their biological, philosophical, and political components. Fukuyama has researched the biology very well, and he brings impressive scholarship and experience to the humanistic dimensions of the issues; moreover, his membership in the President's Council on Bioethics positions him to help shape policies that will regulate biotechnology. For all of these reasons, the book deserves our attention. High school and college-level teachers in science and humanities will discover within it a cornucopia of ideas to stimulate learning-oriented class discussion.

Journal of the Alabama Academy of Science, Vol. 73, No. 4, October 2002.

INDEX

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Minutes
AAS Fall Executive Committee Meeting
Southern Research Institute Library
Birmingham, Alabama
October 19, 2002

Call to Order and Approval of Minutes (A) President Stephen Watts called the meeting to order at 10:09am. Approval of the minutes from the March 27, 2002 meeting at the University of West Alabama was postponed until the Secretary could attach the report of the Executive Director. The Secretary was instrueted to send the present minutes, when completed, to Dr. Hudiburg, Chair of the Electronic Media Committee, for posting on the AAS website.

Officer Reports (B)

1. Eugene Omasta (**Board of Trustees**) had no written report.

2. Stephen Watts (**President**) reported the following activities as part of the duties of the office:
   - I worked with Anne Cusic and other members of the Academy to fill some of the vacancies involved in several of the committees. We are happy to announce that Larry Krannich has agreed to serve as the new executive director.
   - We had an excellent site visit to Jacksonville State University in July. Members of the executive committee met with Frank Romano, Mark Meade and several of the other hosts of the spring 2003 meeting. The food alone will be worth the trip next spring!
   - Worked with Dan Holliman and Lev to determine the location and time of the fall steering and executive committee meeting.
   - Worked with Velma Richardson, Lev and Larry to correct a problem with the Carmichael Award recipients.
   - We were able to reestablish the UAB contribution to the Academy ($500).
   - I am working with Richard Hudiburg to establish the on-line operational capabilities of the AAS. Due to the hard work of Richard, we will soon be able to conduct much of the Academy paperwork and information dissemination via the new web site, www.alabamaacademyofscience.org.

   Steve Watts also reported that Larry Krannich would be taking over the position of Executive Director from Lev Hazelgrove on January 1, 2003

3. Anne Cusic (**First Vice-President**) reported the following activities:
   - Worked with Stephen Watts to fill vacancies on several committees.
   - Worked with Stephen Watts and Lev Hazlegrove to update addresses and emails of officers and committee chairs.

- Consulted with Stephen Watts on several other issues associated with the Academy.
- Attended the site visit to Jacksonville State University (July).
- Studied the Constitution of the Academy to beeome acquainted with the organization of the Aeademy
- Communicated to Ronald Jenkins the dutics of Second Vice-President.
- Worked with Stephen Watts to understand the duties of the President.

4. Ron Jenkins (**Second Vice-President**) had the following report:
   - As second vice-president of the Academy I understand that my principle responsibility is to serve as the nominating committee.
   - In light of thc fact that I am uncertain of the number of nominees or thc responsibilities for these positions, I will delay action until I return from Sweden (Nov. 3, 2003).
   - However, I can say that in order to recruit nominecs, I will cxploit cvcry friend and every enemy that I have at Samford, UAB, Birmingham-Southern, USA, UNA, and any other university. Give my regards to the other members of the executive eommittee. I wish I eould attend the BSC/SRI meeting.

5. The **Secretary** (Dail Mullins) – I report the following activities as part of the duties of the Secretary:
   - Transferred all checks/cash reeeived for dues to the Treasurer after reeording information on the master roll (kept by Ms. Kathryn Pitt);
   - Supplied thc editor of the *JAAS* with membership rolls and mailing labels as requested;
   - Made all requested mailing addrcss changes to the mastcr roll upon receipt of information from individual members;
   - Sent membership lists to each of the Section Heads as requested by the Executive Offieer;
   - Changed the dues notiee eards to refleet the dues increase as requested by the Executive Officer.

   We are getting an increasing number of membership application forms which havc been downloaded from the AAS website. The new dues figures are not yet represented on these forms, and my mailing address is incorreet.

   I would like to request that Officers and Committee Chairs who have relativcly lengthy reports to present at the Executive Committee mcetings in Spring and Fall cmail thesc to thc Secretary as an attachment in Word or WordPerfect as soon after the meeting as possible

6. Larry Krannich (**Treasurer**) submitted the following documents and report:
   ALL ACCOUNT BALANCES as of October 10, 2002
   INCOME & EXPENSE STATEMENT as of Octobcr 10, 2002

ACTIVITIES RELATIVE TO 2000 BUDGET for the period 1/1/02 through 10/12/02
TREASURER'S SUMMARY REPORT BY QUARTER (1/1/02 through 10/12/02)
TREASURER'S SUMMARY REPORT BY ACCOUNT (1/1/02 through 10/12/02)
PROPOSED BUDGET 2003 vs 2002

The total funds in all accounts has increased by $434.20 since the 2001 Fall Treasurer's Report. Although expenses have exceeded inflow by $3,993 to date as compared to $2,286 for the same time period last year, our expenses for the Journal have been $8,223.82 less during 2002. Dues revenue continues to decline in 2002 with only $5,320 collected in 2002 as compared to $7,750 for the same time period in 2001. Because we have averaged $7,600 in collected dues for 2000 and 2001 and the fourth quarter will result in more dues inflow, we will probably end the year meeting that average. We have not received the revenue from the Annual Meeting held on the University of West Alabama campus in 2002 and do not expect much revenue from that meeting. Interest income is below budget, which is consistent with the much lower interest rates being paid in 2002. Support for the journal was just slightly above budget again this year. In the Gorgas and Science Fair categories, we traditionally receive funds which offset the expenses in these categories. All International Science Fair finances were handled directly by the Academy and these are now being reported under the ISEF category in the budget and reports. Science Fair funds ($13,490) were transmitted to the Academy and we payed all expenses ($15,935 - $345.20) for student and Mrs. Valardi's participation in the International Science Fair in Louisville, KY. Disregarding the flow through income budgetary categories, we are approximately $8,000 below budget in anticipated income. On the expense side once we disregard the flow through expense budgetary categories, we can anticipate to be within, if not favorable by $2,000 relative to, the budget that was adopted for 2002. A copy of the Proposed Budget for 2003 is also attached. As you will note, the Proposed Budget for 2003 has been adjusted to reflect dues income of only $7,000, remove flow through of funds for Science Olympiad, and adjust the flow through of funds for ISEF to reflect the Cleveland location.

7. The **Editor of the *JAAS*** (Jim Bradley) was unable to attend the meeting, but submitted a brief written report via email: There is not much to report from the Journal except that the January issue is printed and will be mailed soon, and that the next issue is a combined April-July issue that will contain the meeting abstracts and those symposium papers which were finally submitted.

8. The **Counselor to AJAS** (B. J. Bateman) submitted a written report: 2002 Annual Report of the Alabama Junior Academy of Science and the Junior Science and Humanities Symposium

State Offieers/Counselors Meeting

The State Officers and the State Counselors met at Auburn University to discuss the State Officer's roles for the upcoming year (2001-2002).

Fall AAS Executive Meeting

The State Counselor (B. J. Bateman) attended the Fall Exeeutive meeting of the Senior Aeademy of Seienee held at Southern Rcsearch Center. A report was given coneerning the fortheoming annual meeting to be held at the University of West Alabama in Livingston, Al.

Annual Meeting

The 2002 Annual Meeting, like all previous meetings of AJAS, was shared jointly with the Alabama Aeademy of Seienee. The host institution was the University of West Alabama.

Rebeeea Graham, loeal arrangements for the AJAS, B. J. Bateman, Counselor to the AJAS, and Wanda Phillips Assoeiate Counselor, planned registration proeedures, spaee needs, and arrangements for the AJAS-JSHS social and banquet. Registration was held at the Livingston Motel.

Highlights of the program were:

- Paper Competition - The paper eompetition was eondueted on Friday and Saturday mornings in Wallace Hall on the University of West Alabama Campus. The names of participants are attached.
  Adam Parker was ehosen to be the overall winner and would therefore represent Alabama in national eompetition held at San Diego, Ca. April 24-28. Of the other four state winners (Miehael Vincent, Rebekah Rogers, Alexis Adams, Catherine Barley) only Rebekah, Alexis, Catherine and B. J. Bateman would aeeompany Adam to San Diego.
- Banquet - More than One hundred students, teaehers, university professors, and members of business, industry and government shared the Friday night banquet at the Auburn University Conferenee Center. A major part of the after-dinner program was the reeognition of the first and second-plaee winners of the paper competition, and other eompetitions
- On alternate years the Junior Academy is responsible for the banquet speaker. This year the Alabama Junior Academy of Science provided the banquet speaker, Alford Scholtz, spoke on *"\Alabama's Biodiversity.*
- AJAS-JSHS Soeial Aetivities- The Student Union Building was available for the time after the banquet for fun activities.
- Business Meeting - The customary AJAS business meeting was held on Saturday morning. This provided a time for awarding a plaque to the outstanding region, a eertifieate and a eheek to the outstanding teacher(s), and other awards.

Final Results for 2002 State Science JSHS Paper Competition
Biology Papers:
First Place: Rebakah Rogers, Bradshaw High School
Second Place: Mary Cole, Demopolis High School
Honorable Mention: Clay Foster, Jefferson County International Baccalaureate
Physical Science Papers:
First Place: Alexis Adams, J. O. Johnson High School
Second Place: Whitney Evans, Brooks High School
Humanities Papers:
First Place: Colee Barley, Demopolis High School
Second Place: Wayne Johnson, Brooks High School
Honorable Mention: Mario Butler, J. O. Johnson High School
Engineering Papers:
First Place: Adam Parker, Bradshaw High School
Second Place: Michael Taylor, Bradshaw High School
Honorable Mention: Willie Griffin, J. O. Johnson High School
Mathematics Papers:
First Place: Michael Vincent, Jefferson County International Baccalaureate
Second Place: Irvin Isbell, J. O. Johnson High School
Grant for the Bertie Mae Warren Research Awards
Mary Cole,
AAAS Award
Mary Cole
Outstanding Region
Northwest
Newly elected officers for 2002-2003:

President	Whitney Evans	Brooks High School
Vice-President	Mary E. Cole	Demopolis High School
Treasurer	Michael Taylor	Bradshaw High School
Secretary	Rachel Bradford	Brooks High School

JSHS Participants Attending the Annual Meeting
44 students, sponsors, and counselors attended the annual meeting as JSHS participants.

Results of National meeting
Adam Parker placed second at the national meeting.

9. Virginia Valardi (**Science Fair Coordinator**). Lev Hazelgrove reported that he had received Virginia Valardi's report via email.

10. The **Science Olympiad Coordinator** (Jane Nall) submitted a written report: State of Alabama Science Olympiad 2001-2002

Three Elementary Science Olympiad tournaments were hosted. Hosting schools included Geneva High School, Jacksonville High School, and Auburn University. Forty-seven teams registered.

Institutional faculty, staff, students and volunteers from five Alabama universities hosted five Division C (grades 9-12) tournaments, and four of these schools also hosted tournaments for Division B (grades 6-9). A total of 86 B teams and 76 C teams registered to participate in Alabama Science Olympiad 2001-2002 at Auburn University, Jacksonville State University, University of Alabama, University of Alabama Huntsville, and the University of South Alabama.

Based on the membership on December 1, 2001, a total of 17 B teams advanced to the Alabama Science Olympiad Division B Tournament on April 6, 2002 hosted by Huntingdon College in Montgomery, and 16 C teams competed at Samford University in Birmingham on April 13.

Because participation in the Alabama Science Olympiad continues to rank in the top ten for registered teams in the United States and Ontario, two teams from both the B and C state tournaments earned the invitation to compete in the National Science Olympiad Tournament on the campus of the University of Delaware in Newark, Delaware May 17-18, 2002.

Additional hosts, especially for both Division A (elementary) and Division B (grades 6-9) are needed. The director is also seeking financial assistance to provide coaching clinics and workshops in two areas of Alabama where Science Olympiad is not represented by teams or institutions hosting tournaments.

Under consideration is inviting schools never having been members in Science Olympiad to receive a reduced registration fee and compete at a tournament one time.

Registration fees for Alabama Science Olympiad teams will be the same as this year from May 15 - November 1, 2002, but increase after November 1. No registrations will be accepted after December 15, 2002.

The web master, David Peters, continues to maintain the Alabama Science Olympiad web page, and receives many compliments from people across the United States. It is updated as often as necessary, and continues to be a valuable resource.

Director Nall is most appreciative of all those involved in providing "science at its best" to the students of Alabama!

11. Steven Watts (**Counselor to AAAS**) submitted the following report: All state Academics generally maintain an association with the American Association for the Advancement of Science. We are members of the Section on Agriculture, Food and Renewable Resources. There are several other committees that are currently being reorganized in response to the changing scientific environment and the AAS may have

an opportunity to have direct input on these committees. These changes are currently in discussion.

12. **Section Officers** – written reports were submitted for Sections I (Biological Sciences), II (Chemistry), IV (Geography, Forestry, Conservation and Planning), V (Physics and Mathematics), VII (Science Education), IX (Health Sciences).
    - Section I (Biological Sciences, Donald Salter)— The members of the Biological Sciences Section would like to thank the presenters of the 26 oral presentations and 9 poster presentations for their contributions to the success of the 2002 annual meeting held at the University of West Alabama. Two oral and three poster presentations were cancelled (not included in the above totals). The oral presentations were grouped into three sessions on Thursday morning, Thursday afternoon, and Friday afternoon to accommodate the Friday morning Symposium. The poster presentations were given on Friday afternoon along with those from the other sections. Section I Biological Sciences had 7 students that were contestants in the Student Research Award Competition for oral presentations, but there were no competitors in the poster section. Four to 7 judges evaluated the oral presentations for creative thought, significance to the field, thoroughness, technical skill, and clarity. All were very excellent presentations and so it was a tough job to pick the winner. However, the top student presentation for the Student Research Award in Biological Sciences goes to: Alyssa Geis who presented a paper entitled: "Female-Biased Sex Ratio Of Juvenile Kemp's Ridley Sea Turtle Captured Near Cedar Keys, FL", co-authored by Thane Wibbels, University of Alabama at Birmingham.
    - Section II (Chemistry, Steven Arnold)—At the 2002 annual meeting, the Chemistry section hosted six presentations, four oral and two poster. For the coming year, we discussed plans to have a membership/participation drive to encourage strong participation in next year's meeting. We are planning a campaign of letters, email, and visits to campuses to establish contacts and seek candidates for membership.
    - Section IV (Geography, Forestry, Conservation and Planning, Priscilla Holland)— Section IV of the Alabama Academy of Science elected a chair and vice chair at the spring 2002 meeting. Dr. Priscilla Holland was elected chair and Dr. Bill McAllister was elected vice-chair until 2004. Section IV session was held on Thursday with seven papers being submitted, and six presentation. Two student papers were entered in the paper competition. Topics ranged from tropical cyclones in Alabama, growth papers in Huntsville, forests in Sumpter County, watershed planning, using GIS in modeling sustainability, redevelopment in small rural communities to railroad village in South Alabama. In the 2002 annual meeting at the University of West Alabama at Livingston, the Section hosted a total of 10 presentations, 9 oral and 1 poster presentations. The section chair intends to send out letters to all universities/colleges in the state of Alabama offering degrees in Physics/Mathematics encouraging participation of not just the faculty, but also graduate and undergraduate students engaged in research. In doing so, I hope to develop a list of the all programs in the state along with relevant contact in-

formation which can a passed down through generations of section chairs. Sueh a list should cut down the work involved in recruitment efforts in the future.

- Section V (Physics and Mathematics, Sergey Belyi)— In the 2002 annual meeting at the University of West Alabama at Livingston, the Section hosted a total of 10 presentations, 9 oral and 1 poster presentations. The section chair intends to send out letters to all universities/colleges in the state of Alabama offering degrees in Physics/Mathematics encouraging participation of not just the faculty, but also graduate and undergraduate students engaged in research. In doing so, I hope to develop a list of the all programs in the state along with relevant contact information which can a passed down through generations of seetion chairs. Sueh a list should cut down the work involved in recruitment efforts in the future.
- Section VII (Science Education, Jane Nall)— Section VII, the Seience Education Section, of the Alabama Academy of Science met on Friday afternoon, March 29, 2002, at the University of West Alabama, Livingston, Alabama. We had a total of nine members seheduled for presentation and nine presented. During the business meeting, Lee Aggison volunteered to serve as section Vice Chair:

  Lee Allen Aggison, Jr., Ph.D.
  Assistant Professor of Biology
  Director Harte Honors College
  Stillman College
  P.O. Box 4927
  Tuscaloosa, Alabama 35403
  (205) 366-8914

  The outgoing officers are Jane D. Nall, section Chair, and Vice-Chair, Section Chair-Elect Perry Tompkins. Perry Tompkins will serve as Section Chair for 2002-2003 and 2003-2004.

- Section IX (Health Scienees, Peggy Hays)—Robert Pieroni served as Section Chair at the 79th Annual Conference at the University of West Alabama. There were 16 papers.

13. Lev Hazelgrove **(Executive Director)** submitted a written report of aetivities since the Spring meeting: Since the Spring Meeting at University of West Alabama on 27 March 2002 we accepted the following challenges during the past seven months:
    - With the leadership of Dr. Watts, President of AAS, & Dr. Meade, Local Chair, JSU, set up site visit for Friday, 19 July 2002. Great attendance with the above plus Drs. Buckner, Bateman, Omasta, Jenkins, Hayes, Mullins, Cline, Cusic, Romano, Krannich and Dute. The hosts served an excellent luncheon in a beautiful dining hall prepared excellent faeilities for AAS, JAAS, & Gorgas!
    - With the leadership of Drs. Barrett, Chastain, Howell and Tompkins, we set up the AAS booth at Midfield H. S., for Oct. 10 & 11, 2002 for ASTA!!

- Represented AAS at the Alabama Fisheries Association with Dr. Marion & Angus (Gulf Shores Lodge, 14–16 February 2002).
- With Ms. Virginia Vilardi's (Wetumpka H. S.) leadership successfully sent a team of 19 students to the International Science & Engineering Fair, May 12 - 17, 2002, in Louisville, KY, with thirteen winners in this grueling competition! Director James R. Lowery, Mgmt. Support Services, UAB, went ahead three days early to help set up ISEF rules and regulations, and we had no violations!!!
- Prepared the Gorgas Scholarships Report for Alabama Power Foundation meeting, Oct. 18, 1 p.m., with Chair Art P. Beattie, Treasurer, discussed winners that go out of ALABAMA! (Co-chair Dr. Krannich, Co-chair Dr. Buckner)
- Thanks to all AAS members and supporting secretaries including AAS presidents' secretaries. Also Laura Knighten and Kathryn Pitt who worked faithfully to help our (Anne & Lev) administration for 12 years and 40 years of the Gorgas Scholarship to "be ye perfect"!

Committee Reports (C)

Local Arrangements (Frank Romano)— Frank Romano was not able to attend the meeting. Reporting for Dr. Romano was Mark Meade:

- A site visit was held on July 19, 2002 at Jacksonville State University (JSU) to discuss plans for the 2003 meeting at JSU.
- A task force of biology and physical earth sciences faculty at JSU are working on separate tasks such as rooms for sections and judges for events.
- Local arrangements have been made with 3 motels (University, Super 8, and Lenlock) to house participants for the 2003 meeting. Prices range from $36-50.
- Local arrangements were made to have the executive meeting prior to the AAS meeting (March 19, 2003) in the President's dining hall. Price per meals will range from $12-15.
- Arrangements have been made to have the meeting social at the Anniston Museum of Natural History. Prices for the event will be $.
- Arrangements have been made to have the end of the meeting banquet at the JSU Auditorium. Prices for the banquet will be approximately $15.
- Several vendors have been contacted and will sponsor breakfast snacks and finger sandwiches for refreshment areas. Vendors will also set up booths in Martin Hall.
- Plans for a Domestic Preparedness seminar are underway (Barry Cox). An invited USDA speaker is planned to attend.
- Plans to have an available online list of abstracts are underway.

Finance (Eugene Omasta)—.The Alabama Academy of Science continues to be in excellent financial condition with total assets of $72,197. The assets for the past three years as reported at the Fall Executive Committee meetings and Annual Spring meetings of the Academy are listed below:

	Assets	Change
Fall Exec Meeting		
1/1/99-10/?/99	$76,219	-
1/1/00-10/16/00	72,814	-$3,405
1/1/01-10/12/01	71,763	-1,051
Spring Exec Meeting		
1/1/99-12/31/99	$85,330	-
1/1/00-12/31/00		
1/1/01-12/31/01	74,049	-$11,281
1/1/02-12/31/02	79,789	5,740

The dues increase of $5 annually and the reduction of the number of Journal issues from four to three (by combining the abstract issue with another issue) will hopefully correct the downward trend of the assets of the Academy

Essentially, the Treasurer's proposed budget for 2002 is a repeat of the 2001 budget, except for a reduction of $2,000 in projected dues income and the removal of $3,800 in Science Olympiad flow-through funds. I recommend acceptance of the proposed 2003 budget. This motion was seconded and passed.

Membership (Mark Meade)— I report the following activities as part of the duties as the chair:

- A task force has been organized to eliminate members that are no longer in Alabama in order to update our member list.
- Last executive meeting approved increasing member dues to $30. Student membership remains at $15. Lifetime membership increases to $300 1/1/03. This change will be reflected on the membership portion of the registration forms for 2003 meeting at JSU.

Research (Larry Boots)—no report

Long-Range Planning (Ken Marion)—there was no formal report, since the discussions at the Fall Executive Committee meeting are used as "fodder" for thought during the winter. Dr. Marion did indicate that the committee will brainstorm new ways to increase Academy funding, to increase membership rolls, and ways to offset Journal costs. A formal series of recommendations will be made at the Spring meeting.

Auditing-Senior Academy (David Schedler)—no report

Auditing-Junior Academy (Danice Costes)— no report

Editorial Board and Associate Journal Editors (Thane Wibbels)—no report. Stephen Watts announced that UAB had reinstated its annual support to the Journal.

Place and Date of Meeting (Thomas Bilbo)— Plans for future meetings include:

- Jacksonville State University; March 19-22, 2003; Frank Romano (Local Arrangements Chair)
- University of Montevallo; March 17-20, 2004; Houston Byrd and Kay Watts (Local Arrangements Chairs)
- Troy State University-Dothan; 2005; Larry Brown (contact person)

Newsletter/Electronic Media (Chair position open)—no report. Discussion of this committee was postponed to "New Business."

Public Relations (Myra Smith)—no report

Archives (Troy Best)—no report

Science and Public Policy (Dail Mullins)—no report

Gardner Award (Prakash Sharma)—

The first meeting of the Alabama Academy of Science was held at Sidney Lanier High School, Montgomery, AL, April 4, 1924, in conjunction with the Alabama Educational Association meeting. Wright Gardner was elected as an office bearer of the academy in this meeting. Through his early studies he became determined to make teaching and research his two goals for life. The Wright Gardner Award was established, after the name of this great future looking scientist and educator, by the Alabama Academy of Science in 1984, to honor individuals whose work during residence in Alabama has been outstanding. Persons nominated for this award have included researchers, industrialists, clinicians, scholars, and active members and office bearers of the Alabama Academy of Science.

The committee would like to request that each and every member of this academy publicize to individuals, deans, and provosts of colleges and universities, information about this award. Please solicit nominations from individuals and different academic and industrial organizations for this award. The nominations should be forwarded to P. C. Sharma, Chair, Wright Gardner Award Committee, Head of Physics Department, Tuskegee University, Tuskegee, AL 36088. Phone 334-727-8998. email: pcsharma@tusk.edu. Nominations should consist of the following documents:

- Formal nomination letter
- Vitae and at least two letters of reference from peers, administrators or experts in area of research
- One page citation that will be used for presentation of award

The closing date for nominations is November 30, 2002. The award will be presented at the Annual Meeting of the Alabama Academy of Science, March 19-22, 2003, Jacksonville State University.

Dr. Sharma asked the Executive Committee if they considered it ethical to solicit names, and everyone agreed that it was – as well as "recycle" names from previous years.

Carmichael Award (Velma Richardson)— The following report was submitted via email after the meeting:

The article we have selected for the Carmichael Award this year is " Exclusive-PCR with Denaturing Gradient Gel Electrophoresis: A New Approach to Identify Novel Alleles" by Gana Zhou and LaJoyce H. Debro, Department of Biology, and Xianglan Y. Hood, Department of Physical and Earth Sciences, Jacksonville State University. It should be noted that I received responses from all members of the committee.

Unfortunately, I could not attend the fall meeting because of pressing family commitments. I look forward to seeing you in spring 2003.

Resolutions (Priscilla Holland)—no report (although it was suggested that a resolution was likely to be introduced at a later date on behalf of Sam Barker)

Nominating Committee (Ron Jenkins)—no report

Mason Scholarship (Michael Moeller)— Last year we received no completed applications for the William H. Mason Scholarship. This may a reflection on student's perception of the opportunities in education in Alabama, or some sort of 9-11 effect, or a random fluctuation, or due to some other unrecognized factor. The committee hopes to advertise the scholarship as we have in previous years and hopes to attracts a pool of qualified applicants.

The previous recipients of the William H. Mason Scholarship are:

1990-91	Amy Livengood Sumner
1991-92	Leella Shook Holt
1992-93	Joni Justice Shankles
1993-94	Jeffrey Baumbach
1994 -95	(Not awarded)
1995-96	Laura W. Cochran
1996-97	Tina Anne Beams
1997-98	Carole Collins Clegg
1998-99	Cynthia Ann Phillips
1999-2000	Ruth Borden
2000-2001	Karen Celestine
	Amy Murphy
2001-2002	Jeannine Ott

Attached to this report is a copy of an announcement that the committee plans to be sending soon to deans in schools of science and education within Alabama. Members of the AAS Executive Committee are encouraged to copy and disseminate this information.

Gorgas Scholarship Program (Ellen Buckner)—The Gorgas Scholarship committee met at 1:00 pm October 18, 2002, at the offices of the Alabama Power Foundation in Birmingham. Members present were Drs. Barrett, Buckner, Dobbins, Hazlegrove, Krannich and Otto (via

conference call), and Mr. Beattie. Drs Nelson and Sharma were not present. A moment of silence was held in memory of Dr. Barker. His active involvement in the committee was noted as well as his sterling accomplishments in science. Dr. Krannich was voted to be a voting member of the committee for today, prior to his formal approval as Executive Director of the AAS and Co-Chair of the Gorgas.

Reports from the 2002 competition were excellent with all named finalists participating and presenting high quality projects. It was noted that there are many entries that do not make the finals and one was disqualified this year because it was found to have been taken completely from an internet source. The review process and the final judging are invaluable in the screening and final evaluation of the students' work.

Dr. Hazlegrove gave his report noting that he would be stepping down as Chairman after the Jacksonville meeting. He agreed to continue on the committee.

Mr. Beattie gave the report of the Alabama Power Foundation noting the "less than kind" changes in investments this year. As per the agreement the corpus of the Gorgas monies is $300,000. This is the original amount invested and by agreement may not fall below that amount. This represents an additional investment by the Foundation to keep the corpus intact. The awards will not change for 2003 and will remain at $11,500 with the top award at $4000.

Dr. Buckner discussed recruitment efforts and will work with Dr. Otto and Dr. Krannich in the coming year to increase teacher involvement through the *Science in Motion* network and the in-service education system for teachers. Discussion was held on allowing students from other states to enter but this was not actively considered at this time.

Dr. Buckner asked for discussion regarding waiver of the "in-state" rule requiring students to go to an Alabama college or university to receive awards. Dr. Krannich made a motion that we waive the rule for 2003. There was discussion and it was felt this increases the quality of the competition as well as rewarding the most accomplished students. Dr. Buckner had surveyed seven (7) State Science Talent Search directors and only had a response from one (NY) who reported that they did not have a scholarship program comparable to ours. The committee noted that we have much to be proud of in the outstanding competition in Alabama. The motion to waive the rule for 2003 passed unanimously.

Dr Dobbins stated the importance of continuing to evaluate these changes and to track the winners and finalists. She and Dr. Buckner plan to work on a survey for students. There being no additional business, the meeting was adjourned at 1:35 pm.

Electronic Media (Richard Hudiburg)— I report the following activities:

1. Transferred the web pages for the Academy from the University of North Alabama www2 server to the web hosting server (www.powweb.com). The web pages for the Alabama Academy of Science are now located at the URL: http://www.alabamaacademyofscience.org . It was decided that a complete switch to the web hosting site would done earlier than planned in preparation for the 80th annual meeting. The web hosting server has been fairly reliable over

the past few months. There will be a short disruption of the web hosting server on October 21, 2002.
2. A redirect link has been placed on the University of North Alabama server to academy's website on web hosting. The redirect link provides information for users to adjust their bookmarks/favorites to reflect the academy's new web address.
3. Updated the web pages for the Academy. These updates were to web pages for the academy officers, committees, and sections chairs/vice chairs. Information has been updated on the Committee for Research web pages for submission of materials by students. The application for Academy membership form was changed to note impending dues increase and will be updated to reflect the new dues rates after January 1, 2003.
4. Provided information concerning the Fall Executive meeting and agenda. Placed a "Current Academy News" web page for academy news. I encourage academy members to submit information that might of common interest to other academy members.
5. Discussed adding information on the format of abstracts to be submitted, by mail, to the Editor of the *Journal of the Alabama Academy of Science*.

It was moved, and seconded, that all reports be accepted. Passed unanimously.

Old Business (D)—There was no Old Business

New Business (E)—Several items of New Business were brought up for discussion:

- Ellen Buckner announced that she was working on an anecdotal biography of Sam Barker, and asked for suggestions and contributions
- Richard Hudiburg was elevated to Editor of Electronic Media. Since this is a new committee, the office and appointment will necessitate a change in the Constitution
- It was stressed again that the Newsletter Committee needs to become active
- Anne Cusic raised the issue of the AAS Constitution, and the fact that much of it is out of date. She indicated that she will try to form an ad hoc committee to look at sections which need changing, and try to have recommendations ready by the Jacksonville State meeting
- The Treasurer will have to be replaced by the New Year – several names have been suggested
- The current Treasurer voiced concern about the fact that the Academy has no endowments, nor a development group to seek endowments for such things as the Journal, travel awards, etc. Dr. Krannich said such financial vehicles could easily be incorporated with Compass Bank.
- Dr. Prakash Sharma, Chair of the Wright Gardner Award Committee, suggested that the AAS should begin establishing "Fellows" – honorifics for 4-5 people each year who are doing exceptional work

Adjournment (F)—the meeting was adjourned at 12:25pm

Respectfully submitted,

Dail W. Mullins, Jr.
Secretary

Journal of the Alabama Academy of Science, Vol. 73, No.4, October 2002.

2002 MEMBERSHIP ROLL BY SECTION

SECTION I
BIOLOGICAL
SCIENCES

Aggison, Lee
Aikman, Stephanie
Alexander, Stephanie
Allan, Mary Ann
Angus, Robert
Bailey, Karan
Bailey, Mark
Baker, Dan
Bannaga, Osman
Barbaree, James M.
Beaird, Janis
Beasley, Phil
Beck, Michelle
Bej, Asim Kumar
Best, Tory L.
Beyers, Robert J.
Blackwell, Eric A.
Blair, Benjie
Blankinship, Lisa Ann
Boettcher, Anne
Boettger, Stefanie A.
Bowen, William R.
Boyd, Robert
Bradley, James T.
Braid, Malcom
Buchanan, Lisa White
Buckner, Richard L.
Burnes, Brian S.
Campbell, P. Samuel
Canerday, James V.
Carey, Steven D.
Carter, Gregory A.
Carter, Jacqueline
Cassell, Gail H.
Clements, Ben A.
Cline, George
Cohen, Glenn
Collier, Lyndell
Collins, Christa
Conway, Rebecca P.
Conway-Myers, Barbara
Crews-Oyen, Amy
Croll, Suzanne
Cunningham, Adele
Curl, Elroy A.
Dapper, J. William
Davenport, Lawrence J.
Davis, Rakesha L.
Davison, Paul G.
Denton, Tom E.
Diamond, Alvin R.
Diener, Urban L.
Dindo, John
Dobbins, Betsy
Duckworth, Tracy
Dusi, Julian L.
Dusi, Rosemary D.
Dute, Roland R.
Estes, Jennifer
Estridge, Barbara H.
Folk, Travis
Frandsen, John C.
French, Elizabeth
Gannon, Andrew T.
Garstka, William
Geis, Alyssa
George, Bobby
Gibbs, Brian
Gibbs, Victoria
Goodman, Tomiko
Greer Stephen
Grizzle, John M.
Gudauskas, Robert T.
Haggerty, Thomas M.
Halbrooks, Ron
Hall, Rosine W.
Hamissou, Heather
Hamissou, Mijitaba
Hammer, Hugh S.
Han, Dueg-Woo
Henderson, Barbara
Henderson, James H.
Higgingbotham, Jeri W.
Hileman, Douglas R.
Hofer, Scott
Holland, Richard D
Holliman, Dan C.
Hood, Xianglan Y.
Hopkins, Thomas S.
Huang, Yusheng
Hunter, Eric
Ivey, William D.
Jandebeur, Thomas S.
Jenkins, Ronald L.
Johnson, Adriel D.
Johnson, Jacqueline U.
Johnson, Kataren
Kaufman, Greer
Killough, Gayle H.
Kittle, Paul
Kopaska-Merkel, Andrew
Koopman, William J.
Leahy, Joseph G.
Lee, Kara J.
Leitner, Carol
LeLong, Michel G.
Lishak, Robert S.
Loop, Michael S.
Mahon, Andrew R.
Marion, Ken Roy
Mateescu, Madalina

Mathews Jr, Joseph W.
McCall, John
McClintock, James B.
McGregor, Stuart W.
McKenzie, Gail O.
McLaughlin, Ellen W.
Meade, Mark E.
Meyer, Thomas Joshua
Miller, Michael E.
Miller-Way, Tina
Mirarchi, Ralph E.
Moore, Debra S.
Moore, Jack H.
Moore, Teresa Kelley
Morgan, Darrell
Moriarity, Debra M.
Morris, James
Moss, Anthony G.
Muellner, Lisa
Murdock, Chris
Myers, Michael L.
Nancarrow, D. Virginia
Nance, Marione E.
Nelson, David H.
Neidermeier, William
O'Brien, Jack (John J.)
Olander, Charles
Owens, Janna
Panicker, Gitika
Parrish, Scott C.
Payne, Dorothy
Pezzementi, Leo
Pierson, J. Malcom
Powell, Mickie L.
Pritchett, John F.
Quindlen, Eugene A.
Ramsey, John S.
Rayburn, James
Regan, Gerald T.
Reynolds, W. Ann
Richardson, Velma
Riley, Thomas N.
Robertson, B.K.
Robinson, George H.
Rohrer, Shirley
Romano, Frank A.
Rowell, Craig
Saldanha, Sabita
Salter, Donald W.
Sauterer, Roger
Schlundt, A.F.
Shardo, Judith D.
Shew, H. Wayne
Singh, Shiva P.
Sizemore, Doug
Smith, Bruce F.
Somershoe, Scott
Spaulding, Dan
Spencer, Elsie
Ssenkoloto, Margaret
Stanko, Jason
Stewart, Paul
Stober, Lauree
Strada, Samuel J.
Sundermann, Christine
Suppiramanian, Vishnu
Thompson, Larry E.
Thomson, Sue
Tolar, Joe
Tollefsbol, Trygve
van Amerongen, Krista
Varner, Morgan
Vickery, Michael C.L.
Walker, J.H.
Wall Jr, Benmamin R.
Walser, Chris
Ward, Edward R.
Washington, Ruth
Watson, R. Douglas
Watts, Stephen A.
Whitehead, Alan
Wibbels, Thane
Wilkes, James C.
Wilson, Thomas H.
Wit, Lawrence C.
Wolfe, Andrea
Woods, Michael
Wujek, Daniel E.
Wymer, Douglas
Zhou, Gang

SECTION II
CHEMISTRY
Abdalla, Mohamed O.
Advincula, Rigoberto
Arnold, Steven E.
Asouzu, Moore U.
Bailey, David
Barrett, William J.
Bezoari, Massimo D.
Brouillette, Wayne J.
Brown, Mary Ann Higgs
Bugg, Charles E.
Bush, Russell C.
Campbell, Amy
Cappas, Constantine
Chastain, Ben B.
Claude, Juan Pablo
Dillon, H. Kenneth
Doorenbos, Norman
Finkel, Joe M.
Finley, Sara
Finley, Wayne H.
Friedman, Michael E.
Gabre, Beminet
Gebeyehu, Zewdu
Haggard, James H.
Hamilton, Tracy
Hazlegrove, Leven S.
Ihejeto, Godwin
Isbell, Raymond E.
Jones-Gregory, Denise
Kelly, Janice
Koons, L.F.
Krannich, Larry K.

Lambert, Brandy
Ludwick, Adriane
March, Joe
Mays, Jimmy
McDonald Nancy C.
Moeller, Michael
Moore, McDonald
Mountcastle, William
Muccio, Donald
Nichols, Alfred
Odutola, J. Adeola
Olive, Brentley S.
Otwell, H. Blake
Perine, Don R.
Phillips, Joy
Ponder, Morgan C.
Rampersad, Dave
Riordan, James M.
Schedler, David J.A.
Schnupf, Udo
Sheridan, Richard C.
Stanton, Clyde T.
Thomas, Joseph C.
Thompson, Davis Hunt
Vallanino, Lidia M.
Vincent, John B.
Watkins, Charles L.
Webb, Thomas R.
Weiss, Stephanie T.
Wells, David
Wheeler, G.P.
Wierengo, C. John

SECTION III
EARTH SCIENCE
Allison, David
Barwood, Henry
Bersch, Michael
Blackwell, Keith G.
Brande, Scott
Cranford, Norman B.
Dean, Lewis S.
Fisher, Anthony
George, Lois
Haywick, Douglas W.
Kopaska-Merkel, David
Lowery, James R.
McMillan, Richard C.
Neathery, Thornton L.
Neilson, Michael J.
O'Donnell, Daniel J.
Rindsberg, Andrew K.
Robinson, James L.
Selby, James K.
Sheldon, M. Amy
Sitz, Willard L.
Skotnicki, Michael C.
Stock, Carl W.
Thurn, Richard L.

SECTION IV
GEOGRAPHY,
FORESTRY,
CONSERVATION, AND
PLANNING
Boyer, William
Brown, Lawrence
Chaney, Philip
Curtis, Kendrick J.
Dabbs, Merilyn O.
Devall, Wilbur B.
Gibbs, George S.
Henderson, H.A.
Himmler, Frank N.
Holland, A. Priscilla
Izeogu, Chukudi V.
Klimasewski, Ted
Kush, John S.
Mance, Angelia
Martinson, Tom L.
Marzen, Luke J.
McAllister, William K.
Mullen, Michael W.
Outland, Donald E.
Richetto, Jeffrey P.
Rivizzigno, Victoria
Roy, Luke A.
Strong, William R.
Tang, R.C.
Twumasi, Yaw
Vickery, Minako
Wilson, Constance

SECTION V
PHYSICS AND
MATHEMATICS
Aggarwal, Manmohan D.
Alford, William L.
Atkinson, Bruce W.
Baksay, Laszio
Bateman, B.J.
Bauman, Robert P.
Bearden, T.E.
Beiersdorf, Peter
Belyi, Sergey
Boardman, William J.
Carnevali, Antonino
Chestnut, John B.
Comfort, Richard
Datta, Anjali
Essenwanger, Oskar M.
Forte, Aldo
Furman, W.L.
Glotfelty, Henry W.
Gonzalez, Thomas E.
Harrison, Joseph G.
Harrison, Randall
Hawk, James F.
Helminger, Paul
Holliday, Gregory S.
Horsfield, Christopher
Howell, Kenneth B.
Jenkins, Charles M.
Jones, Stanley T.
Kannar, Sher S.
Knight, Martha V.

Kornman, Paul T.
Legge, Jennie
Lester, William L.
Lundquist, Charles A.
Marian, Gyongyi
Massey, Julia E.
Menon, Govind
Mixon, Stacy Tyrone
Moore, Carey
Omasta, Eugene
Parks, Larry
Podder, Nirmol
Pontius, Duane
Ratkovich, Thomas J.
Reid, William J.
Reisig, Gerhard
Robinson, Edward L.
Roblee, Kenneth
Ruffin, Paul B.
Sanders, Justin M.
Sharma, P.C.
Shealy, David L.
Smith, Bryan
Smith, Micky
Soumonni, Ogundiran
Stanley, Sonya S.
Swinney, Kenneth R.
Tarvin, John T.
Tompkins, Perry
Varghese, S.L.
Wheeler, R.E.
Wills, Edward L.
Young, John H.

SECTION VI
INDUSTRY AND
ECONOMICS
Absher, Keith
Alexander, Paulette
Anantharaman, Sekhar
Banks, Bonnie M.
Barrett, Doug
Briggs, Charles
Bullard, William R.
Cameron, Michelle A.
Crawford, Gerald
Ferry, Jerry
Gabre, Helen G.
Gabre, Teshome
Gabremikael, Fesseha
Griffin, Marsha D.
Jain, Rohit
Jones, T. Morris
Keener, Manuel
Lovik, Lawrence W.
McCain, J. Wayne
Murray, Gerald D.
Pride, Tywana M.
Rahimian, Eric
Singleton, Tommie
Suwanakul, Sontachai
Viohl, Frederick A.
Wheatley, Robert
Williams, Robert J.

SECTION VII
SCIENCE EDUCATION
Alexander, Janet G.
Anderson, Trudy S.
Baird, Bill
Benford, Helen H.
Biddle, Laurie R.
Bilbo, Thomas
Burgess, Tyler
Caudle, Sandra I.
Crowe, Brandon
Fish, Frederick P.
Froning, Michael
George, Joseph D.
Hawk, Richard
Kastenmayer, Ruth W.
Landers, John I.
Morgan, Eugenia L.
Nall, Jane
O'Brien, James M.
Riggsby, Dutchie S.
Riggsby, Ernest D.
Robinson, Jennifer
Rowsey, Robert E.
Schotz, Linda C.W.
Shepard, Susie H.
Shumaker, Anne W.
Smith, Karl Dee
Vilardi, Virginia
Wilson, Karl M.

SECTION VIII
BEHAVIORAL AND
SOCIAL SCIENCES
Banks, Janice
Barty, Peter F.
Bates, Larry
Brown, David C.
Buckalew, L.W.
Burns, Jerald C.
Collins, Kenneth
Easterday, Norman E.
Fisher, Gerald P.
Gray, John
Halbrooks, Elizabeth A.
Hall, Laura
Harris, Louis M.
Haynes, Mike
Holliman, Diane Carol
Hudiburg, Richard A.
Jayroe, Monica
Johns, Marci
Johnson, James A.
Jones, Tim R.
Luskin, Joseph
McPherson, Gloria
Miller, Ellaine B.
Mullins, Larry C.
Newton, Dahlia B.
Norton, Emily C.
Osterhoff, William F.
Powell, Larry

Roberts, Robin
Rosser, Quita
Thetford, Robert
Van Der Velde, Robert J.
Vocino, Thomas
VonAh, Diane
Wang, Jifu
Weber, B.C.
Wheelock, Gerald C.
Wilke, Arthur
Wittekind, Janice
Yeager, J.H.

SECTION IX
HEALTH SCIENCES
Allegretti, Christina
Beaton, John M.
Beck, Lee R.
Boots, Larry R.
Bothe, Olaf
Briles, David E.
Buckner, Ellen
Conary, Jon T.
Cusic, Anne
Davis, Richard
Davis, W.R.
DeRuiter, Jack
Edge, Kayla
Eley, John G.
Emerson, Geraldine M.
Eustace, Larry W.
Findlay, Margaret
French, Elizabeth
Fruh, Sharon
Garrison, Carol
Gilbert, Fred
Goudreau, Kelly A.
Grant, Joan S.
Greenwood, Rebecca
Guthery, Dana S.
Guy, Dena
Gwebu, Ephriam T.
Gwebu, Keratiloe
Han, Jian
Harris, Jennifer E.
Harvey, Heather
Hays, M. Peggy
Herbert, Donald
Hicks, Julius
Holl, Genevieve
Iddins, Brenda W.
Ingram, Jacqueline
Jackson, Charles
Johnson, Vicki Y.
Johnston, Sarah R.
Jones, Francine C.
Jones, Jason A.
Katz, Judd A.
Lammon, Carol Ann
Lester, Belinda A.
Mallory, Wendy
Martinson, Jodelle
Mathew Jr., Thomas
McAfee, Kelly
McCallum, Charles A.
McNeil, Betina
Miller, Leah
Mullins Jr., Dail W.
Navia, Juan M.
Nelson, Deborah B.
Pakapong, Yothaka
Parsons, Daniel L.
Perry, Brooke
Phillips, Joseph B.
Pieroni, Robert E.
Pittman Jr., James A.
Pitts, Marshall
Pritchett, Jennifer
Reed, Linda
Revis, Deborah
Rigsby, Andi
Rodning, Charles B.
Ross, M. Candice
Roush, Donald
Rudd, Steven
Ruff, David II
Rush, Melinda
Rushing, Karen
Sanford, Jon E.
Schnaper, Harold W.
Shields, Catherine
Shoemaker, R.L.
Skalka, Harold W.
Smith, Myra A.
Sprague, Michael L.
Sullivan, Linda
Taylor, Catherine
Thompson, Jerry N.
Turrens, Julio F.
West, Kat
Wilborn, W.H.
Williams, Amy
Winters, Alvin L.
Wynn, Theresa A.

SECTION X
ENGINEERING AND
COMPUTER SCIENCE
Barrett, John
Bekele, Gete
Bright, Tommy G.
Bryant, Barrett
Burt, Carol
Cameron, Marietta E.
Cao, Fei
Craig, Thomas F.
Das, Kalyan Kumar
Dean, Susan T.
Drake, John M.
Ensminger, David
Feinstein, David L.
Francis, Lara
Garza, Gene G.
Hilyer, William A.
Jacobs, Paul L.
Kurzius, Shelby C.

Lee, Beum-Seuk
Liu, Danyu
Lumpkin, Sam
Panwhar, Samina
Parker, Donald L.
Pitt, Robert E.
Raje, Rajeev R.
Raju, P.K.
Ray, Cari
Roy, Sanjeev R.
Sloan, Kenneth R.
Sprague, Alan P.
Srinivas, Raghavan N.
Thomas, Robert E.
Walters, J.V.
Wisniewski, Raymond B.
Wu, Xiaqing
York, Gary
Zhang, Mila
Zhao, Wei
Zheng, Xidong
Zhou, Song

SECTION XI
ANTHROPOLOGY
Cole, Brigitte
Driskell, Boyce N.
Gage, Matthew D.
Henson, B. Bart
Holstein, Harry O.
Hurley, Molly
Koerper, Philip E.
Mann, Jason A.
Rowe, Bobby
Runquist, Jeanette
Speegle, Heath F.
Twe, Kyla Elizabeth

Notes

INSTRUCTIONS TO AUTHORS

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Submission: Submit an original and two copies to the editor. Papers which are unreasonably long and verbose, such as uncut theses, will be returned. The title page should contain the author's name, affiliation, and address, including zip code. The editor may request that manuscripts be submitted on a diskette upon their revision or acceptance.

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